Service Manual
Maintenance, Tuning and Unit Replacement
Passenger Cars starting August 1959

Service

Daimler-Benz Aktiengesellschaft
Stuttgart-Untertürkheim
Export-Service

This

Service Manual
Maintenance, Tuning and Unit Replacement
Passenger Cars starting August 1959

contains — in addition to maintenance and lubrication — all important adjustment and component replacement operations as well as the necessary data, measurements and tolerances.

The present manual refers to the vehicles built since 1959 of the models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL and 300 SE including Coupes and Convertibles. These are, however, only mentioned separately in those cases where they deviate from the sedans. To save space the following abbreviations are frequently used behind the model designation:

"Cp" for Coupe; "Ca" for convertible and
"C" if both versions are referred to.

The entire contents of this service manual is subdivided into groups, and within the groups into job numbers. The group index on the following page makes finding the various groups more convenient. Each group has an index to show the job numbers.

The terms "left, right, front or rear" as used in the text refer to the direction of travel if not otherwise designated.

To keep this manual constantly up to date supplements giving information on important modifications and novelties will be issued as necessary. Supplements up to and including supplement no. 31, published before this new edition was printed, are included in this issue.

Stuttgart-Untertürkheim

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Explanatory Notes on the Supplements

These supplements consist of "Modifications" and Supplements" proper.

Modifications

Each sheet on which a modification, correction or addition has been made, is marked "Modification" at the bottom together with the serial number, the date, and the title of the manual.

In addition, there is on top of the page a brief note in italics showing the type and extent of the modification.

Sheets containing tables are often marked "Modification". This means that modifications and corrections or additional tables are marked with an asterisk (*).

Supplements

New Job Nos. are marked in this way. The designation "Supplement" is also to be found at the bottom with details of the serial number, the date, and the title of the manual.

Index of Groups

General, Technical Data - Group 0

Technical Specifications 220 b, 220 Sb

Job No.
0-3

Modification: Model 230 SL and Engine 2nd Version for Model 300 SE added

A. Models 190 c, 190 Dc, 220 b, 220 Sb

Type

Car model	190 c	190 Dc	220 b	220 Sb
Chassis type	110.010	110.110	111.010	111.012
Engine model	M 121 B.V	OM 621.III	M 180.IV	M 180.V
Engine type	121.924	621.912	180.940	180.941

Design Characteristics

Standard version	Front disk brakes Two-circuit brake-system with Power Brake T 51[1])			
Optional	DB automatic transmission[2])			
	—		DB power steering	

[1]) As from August 1963. On Model 220 Sb front disk brakes (single-circuit brake-system) as from February 1962.
[2]) Available for Model 190 Dc as from January 1964.

Engine

	190 c	190 Dc	220 b	220 Sb
Operation	4-cycle carburetor	4-cycle Diesel precombustion chamber, constant flow principle	4-cycle carburetor	
Number of cylinders	4		6	
Bore/stroke (mm)	85/83.6	87/83.6	80/72.8	
Total effective piston displacement cc.	1897	1988	2195	
Compression ratio	8.7:1	21:1	8.7:1	
Fire or injection order	1-3-4-2		1-5-3-6-2-4	
Maximum rpm	6000	4350	6000	
Engine performance in metric HP at rpm according to DIN[3]) in grHP at rpm according to SAE	80/5000 90/5200	55/4200 60/4200	95/4800 105/5000	110/5000 124/5200
Maximum torque in mkg at rpm, DIN rating in mkg at rpm, SAE rating	14.5/2500 15.6/2700	11.5/2400 12.0/2400	17.2/3200 18.4/3300	17.5/3500 19.2/3700
Crankshaft bearings	Compound plain bearings with steel-backed shells 3		4	
Connecting rod bearings	Compound plain bearings with steel-backed shells			
Valve arrangement	overhead vertical			
Camshaft location	top			
Oil cooling	Oil-water heat exchangers			
Cooling system	Water circulation through pump, thermostat with by-pass pipe and fan			
Lubrication	Forced-feed lubrication by means of gear-type pump			

[3]) The metric horsepower specified is actually available at the clutch, since the power used by the engine accessories has already been deducted.

Model	190 c	190 Dc	220 b	220 Sb

Electrical Equipment

		190 c	190 Dc	220 b	220 Sb
Battery	voltage (V)	12	12	12	
	capacity (Ah)	52[1]	66	52[1]	

Dimensions

		190 c	190 Dc	220 b	220 Sb
Track (mm)	front	1482[2]			
	rear	1485			
Wheel lock	inner	39°			
	outer	32° 30'		33°[3]	
Minimum turning circle (m)		approx. 11.4		approx. 11.5	
Wheel base (mm)		2700		2750	
Length of vehicle (mm)		4730		4875	
Width of vehicle (mm)		1795			
Height of vehicle, curb condition (mm)		approx. 1495		approx. 1500	
Ground clearance, carrying 2 persons (mm)		approx. 190		approx. 200	

Weights

	190 c	190 Dc	220 b	220 Sb
Dry weight of vehicle without fuel, spare wheel and tools kg	1175	1225	1230	1255
Unladen weight of vehicle, in curb condition, with full fuel tank, spare wheel and tools kg	1250	1300	1320	1345
Permissible total weight kg	1750	1800	1820	1845
Permissible axle load kg front/rear	790/960	830/970	840/980	855/990

Capacities

			190 c	190 Dc	220 b	220 Sb
Fuel tank/reserve	fuel	appr. Ltr.	52/5		65/7[4]	
Cooling system with heating	water	appr. Ltr.	10.1		11.4	
Crankcase (without oil filter)	Engine oil max/min	Ltr.	4/2.5		5.5/3.5	
Oil filter	Engine oil	appr. Ltr.	0.5	1.0	0.5	
Water pump	Hypoid oil SAE 90	cc.	10			
Hydraulic clutch actuation	ATE blue brake fluid	appr. Ltr.	0.05[5]			
Mechanical transmission	Automatic Transmission Fluid	Ltr.	1.4			
Automatic transmission	Automatic Transmission Fluid	Ltr.	4.75[6]			
Rear axle	Hypoid oil SAE 90	Ltr.	2.5			
Steering	Hypoid oil SAE 90	Ltr.	0.3			
Power steering	Automatic Transmission Fluid	Ltr.	—		1.4	
Front wheel hub	Anti-friction bearing grease	(per hub) g	65—80			
Brake system	ATE blue brake fluid	appr. Ltr.	0.5			

[1] 2nd version; 1st version 12V, 56Ah.
[2] On cars with front disk brakes; was 1468 mm on Model 190 c and 190 Dc cars with front drum brakes; was 1470 mm on Model 220 b and 220 Sb cars with front drum brakes.
[3] For 2nd version front axle; 1st version 29°.
[4] On Model 220 b, 2nd version; 1st version 52/5 liters.
[5] 0.1 liters on cars with internal clutch supply cylinder.
[6] Applies to first filling only, for oil changes appr. 1 liter less.

Model	190 c		190 Dc		220 b		220 Sb	

Speeds, Consumption Figures, and Operating Conditions

At rear axle ration i =	1:4.10		1:3.90		1st vers. 1:3.90 2nd vers. 1:4.08		1st vers. 1:4.10 2nd vers. 1:4.08	
	mech. transm.	automatic DB transm.	mech. transm.	automatic DB transm.	mech. transm.	automatic DB transm.	mech. transm.	automatic DB transm.
Maximum speeds in the individual gears (km/h) timed								
1st gear	42		32		42[7])		42[7])	
2nd gear	68		55		70		70	
3rd gear	111		86		114		114	
4th gear	approx. 145	142	approx. 125[5])	approx. 123	approx. 155	approx. 150	approx. 165	approx. 160
Climbing ability (%)								
1st gear	58	55	38	36	61[8])	58	65[8])	62
2nd gear	29	31	20	21	31.5	32	18.5	34
3rd gear	17		12		18.5	18	32	19
4th gear	9.6		6.5		10.6	9.8	10.6	10
Acceleration time in 4th gear, from 20 to 100 km/h[1]) (sec)	26.5	18[9])	26[6])	30[9])	26	—	25.5	18[9])
Engine speed at 100 km/h in 4th gear (rpm)	3520		3350		3260		3430	
Fuel consumption Consumption for average highway travel (ltr/100 km)[2])	7.5—11.5		6.5—8.5		standard clutch 8.5—12.0 automatic clutch 8.8—12.5		standard clutch 8.5—11.5 automatic clutch 8.8—12.0	
Fuel consumption according to DIN 70030[3]) (ltr/100 km)	10.8 at 109 km/h		7.6 at 93.7 km/h		standard clutch 11.2 at 110 km/h automatic clutch 11.4 at 110 km/h		standard clutch 10.7 at 110 km/h automatic clutch 10.9 at 110 km/h	
Engine oil consumption (ltr/100 km)	0.15							
Cooling water working temperature (°C)	70°—95°							
Fuel	Premium or benzol-gasoline mixture		Diesel fuel DIN 51601		Premium or benzol-gasoline mixture			
Antiknock rating (Minimum ROZ) — for maximum output[4])	96		—		96			
Antiknock rating (Minimum ROZ) — with maximum retardation of ignition involving a loss of performance	90		—		90			

[1]) Vehicle carrying 2 persons.
[2]) On cars with automatic transmission, fuel consumption figures are about 5—8 p.c. higher.
[3]) Determined at 3/4 of the maximum speed, at a maximum of 110 km/h with a 10 % increase.
[4]) The gasoline engines are adjusted at our works with commercial fuels to maximum output. If it should be necessary for a limited period of time to use fuels with an anti-knock rating below that given for maximum output the ignition must be retarded accordingly in all cases.
[5]) On down grades a maximum speed of 134 km/h must on no account be exceeded.
[6]) Acceleration time in 4th gear from 40—100 km/h in sec.
[7]) With gear ratio 1st gear 1:4.05. Was 45 km/h at gear ratio 1:3.64.
[8]) With gear ratio 1st gear 1:4.05. Was 55 % on Model 220 b and 58 % on Model 220 Sb at gear ratio 1:3.64.
[9]) From 0—100 km/h in shift position "4" with kickdown.

B. Models 220 SEb, 230 SL

Type

Car model	220 SEb Sedan	220 SEb/C		230 SL
Chassis type	111.014	Coupé 111.021	Convertible 111.023	113.042
Engine model	M 127.III	M 127.V		M 127.II
Engine type	127.982	127.984		127.981

Design Characteristics

Standard version	Front disk brakes Two-circuit brake system with Power Brake T 51[1])
Optional	DB automatic transmission
	DB power steering

[1]) On Model 220 SEb as from August 1963. Front disk brakes with single-circuit brake-system as from February 1962.

Engine

Operation	4-cycle gasoline injection	
Number of cylinders	6	
Bore/stroke (mm)	80/72.8	82/72.8
Total effective piston displacement (cc)	2195	2306
Compression ratio	8.7:1	9.3:1
Fire order	1-5-3-6-2-4	
Maximum rpm	6000	6500
Engine performance in metric HP at rpm according to DIN[2]) in gr HP at rpm according to SAE	120/4800 134/5000	150/5500 170/5600
Maximum torque in mkg at rpm, DIN rating in mkg at rpm, SAE rating	19.3/3900 21.0/4100	20/4200 22/4500
Crankshaft bearings	Compound plain bearings with steel-backed shells 4	
Connecting rod bearings	Compound plain bearings with steel-backed shells	
Valve arrangement	overhead vertical	
Camshaft location	top	
Oil cooling	Oil — water heat exchangers	
Cooling system	Water circulation through pump, thermostat with by-pass pipe and fan	
Lubrication	Forced-feed lubrication by means of gear-type pump	

[2]) The metric horsepower specified is actually available at the clutch, since the power used by the engine accessories has already been deducted.

0-3/4

Model	220 SEb Sedan	220 SEb/C	230 SL

Electrical Equipment

Battery	voltage (V) capacity (Ah)	12 55¹)		

Dimensions

Track (mm)	front	1482²)			1486	
	rear	1485			1487	
Wheel lock	inner	39°				
	outer	33°³)			34° 20′	
Minimum turning circle (m)		11.5			10	
Wheel base (mm)		2750			2400	
Length of vehicle (mm)		4875	4880		4285	
Width of vehicle (mm)		1795	1845		1760	
Height of vehicle, curb condition (mm)		1500	Cp 1420	CB 1430	Cp 1290	Roadster 1305
Ground clearance, carrying 2 persons (mm)		appr. 200	appr. 175⁴)		140	

Weights

Dry weight of vehicle without fuel, spare wheel and tools (kg)	1285	Cp 1320	CB 1420	1210
Unladen weight of vehicle, with full fuel tank, spare wheel and tools (kg)	1375	1410	1510	1295
Permissible total weight (kg)	1875	1880	1980	1650
Permissible axle load (kg) front/rear	875/1000	880/1000	915/1065	800/850

Capacities

Fuel tank/reserve	fuel	appr. Ltr.	65/7	
Cooling system with heating	water	appr. Ltr.	11.4	10.8
Crankcase (without oil filter)	Engine oil max/min	Ltr.	5.5/3.5	
Oil filter	Engine oil	appr. Ltr.	0.5	
Water pump	Hypoid oil SAE 90	cc	10	
Hydraulic clutch actuation	ATE blue brake fluid	appr. Ltr.	0.05⁵)	
Mechanical transmission	Automatic Transmission Fluid	Ltr.	1.4	
Automatic transmission	Automatic Transmission Fluid	Ltr.	4.75⁶)	
Rear axle	Hypoid oil SAE 90	Ltr.	2.5	
Steering	Hypoid oil SAE 90	Ltr.	0.3	
Power steering	Automatic Transmission Fluid	Ltr.	1.4	
Front wheel hub	Anti-friction bearing grease	(per hub) g	65—80	
Brake system	ATE blue brake fluid	appr. Ltr.	0.5	

¹) 2nd version; 1st version 12 V, 60 Ah.
²) On cars with front disk brakes; was 1470 mm on Model 220 SEb Sedan with front drum brakes.
³) For 2nd version front axle; 1st version 29°.
⁴) Vehicle carrying 2 persons in front seats and 1 person in rear seat.
⁵) 0.1 liters on cars with internal clutch supply cylinder.
⁶) Applies to first filling only, for oil changes approx. 1 liter less.

Model	220 SEb Sedan	220 SEb/C	230 SL

Speeds, Consumption Figures, and Operating Conditions

	220 SEb Sedan mech. trans.	220 SEb Sedan autom. DB trans.	220 SEb/C mech. trans. Cp	220 SEb/C mech. trans. CB	220 SEb/C autom. DB trans. Cp	220 SEb/C autom. DB trans. CB	230 SL mech. trans.	230 SL autom. DB trans.
At rear axle ratio i =	1st vers. 1:4.10 2nd vers. 1:4.08						1:3,75	
Maximum speeds in the individual gears (km/h) timed								
1st gear	42[5])		42[5])				45	
2nd gear	70		70				90	80
3rd gear	114		114[6])				135	130
4th gear	appr. 170	appr. 165	appr. 170		appr. 165		200	195
Climbing ability (%)								
1st gear	71	68	71	64	68	61	80	70
2nd gear	35	36	35	32	36	33	33	37
3rd gear	19.5	20	19,5	18	20	18	19	19.5
4th gear	10.7	10.1	10,7	10	10,1	9,4	10	10.2
Acceleration time in 4th gear from 20—100 km/h (sec)	23	13.5[10])	23	24	13.5[10])		21	11.5[10])
Engine speed at 100 km/h in 4th gear (rpm)	3420[7])						3145	
Fuel consumption Consumption for average highway travel (ltr./100 km)	8.0—11.5[8])						10—15	
Fuel consumption according to DIN 70030 (ltr./100 km) [3])	10.7 at 110 km/h[9])						10.2 at 110 km/h	
Engine oil consumption	0.15						0.20—0.25	
Cooling water working temperature (° C)	70—95							
Fuel	Premium or benzol-gasoline mixture							
Antiknock rating (Minimum ROZ) for maximum output [4])	96						98	
Antiknock rating (Minimum ROZ) with maximum retardation of ignition involving a loss of performance	90							

[1]) Vehicle carrying 2 persons.
[2]) On cars with automatic transmission fuel consumption figures are about 5—8 p.c. higher.
[3]) Determined at 3/4 of the maximum speed, at a maximum of 110 km/h with a 10 % increase.
[4]) The gasoline engines are adjusted at our works with commercial fuels to maximum output. If it should be necessary for a limited period of time to use fuels with an anti-knock rating below that given for maximum output the ignition must be retarded accordingly in all cases. See No. 00—7.
[5]) On mechanical transmission with gear ratio 1st gear 1:4.05. Was 45 km/h at gear ratio 1:3.64.
[6]) On Model 220 SEb Convertible 115 km/h.
[7]) On Model 220 SEb Convertible 3410 rpm.
[8]) On Model 220 SEb Convertible 8.5—12.0 ltr.
[9]) On Model 220 SEb Convertible 11.2 ltr.
[10]) From 0—100 km/h in shift position "4" with kickdown.

C. Model 300 SE

Type

Carl model	300 SE Sedan standard	300 SE Sedan long	300 SE Coupé	300 SE Convertible
Chassis type	112.014	112.015	112.021	112.023
Engine model	1st vers. M 189.III	2nd vers. M 189.V	1st vers. M 189.IV	2nd vers. M 189.VI
Engine type	1st vers. 189.984	2nd vers. 189.986	1st vers. 189.985	2nd vers. 189.987

Design Characteristics

Standard version	Electromagnetic Fan Clutch[1])			
	DB automatic transmission			
	Air suspension			
	Lock differential with limited slippage			
	Front and rear disk brakes — two-circuit brake system with master vac			
	DB power steering			
Optional units	Rear axle ratio 1 : 3.75		Rear axle ratio 1 : 3.92	
	Mechanical transmission			
	Air conditioning system			
	—	central pneumatic interlock	—	

[1]) With air-conditioning system installed: "hydraulic fan clutch".

Engine

Operation	4-cycle gasoline injection
Number of cylinders	6
Bore/stroke (mm)	85/88
Total effective piston displacement (cc)	2996
Compression ratio	1st vers. 8.7:1; 2nd vers. 8.8:1
Fire order	1-5-3-6-2-4
Maximum rpm	6000
Engine performance in metric HP at rpm according to DIN[1]) / in grHP at rpm according to SAE	1st vers. 160/5000; 185/5200 — 2nd vers. 170/5400; 195/5500
Maximum torque in mkg at rpm, DIN rating / in mkg at rpm, SAE rating	1st vers. 25.6/3800; 28.3/4000 — 2nd vers. 25.4/4000; 28.1/4100
Crankshaft bearings	Compound plain bearings with steel-backed shells 7
Connecting rod bearings	Compound plain bearings with steel-backed shells
Valve arrangement	overhead inclined 20°
Camshaft location	top
Oil cooling	Oil-water heat exchangers
Cooling system	Water circulation through pump, thermostat with by-pass pipe and fan
Lubrication	Forced-feed lubrication by means of gear-type pump

[1]) The metric horsepower specified is actually available at the clutch, since the power used by the engine accessories has already been deducted.

Model	300 SE Sedan standard	300 SE Sedan long	300 SE Coupé	300 SE Convertible

Electrical Equipment

Battery	voltage (V) capacity (Ah)	12 66

Dimensions

		standard	long	Coupé	Convertible
Track (mm)	front	1482			
	rear	1490			
Wheel lock	inner	39°			
	outer	32°			
Minimum turning circle (m)		11.7	12.0	11.7	
Wheel base (mm)		2750	2850	2750	
Length of vehicle (mm)		4875	4975	4880	
Width of vehicle (mm)		1795		1845	
Height of vehicle, curb condition (mm)		1455		1395	1400
Ground clearance, carrying 2 persons (mm)		183		180	

Weights

The values in brackets apply to cars with a fuel tank capacity of 65 ltr. (1st version)

	standard	long	Coupé	Convertible
Dry weight of vehicle without fuel, spare wheel and tools (kg) appr.	1475	1510	1485	1600
Unladen weight of vehicle, curb condition, with full fuel tank, spare wheel and tools (kg)	1565 (1530)	1615	1590 (1565)	1690 (1665)
Permissible total weight (kg)	2065 (2010)	2115	2060 (2035)	2160 (2135)
Permissible axle load (kg) front	995 (1010)	1015	985	1020 (1035)
Permissible axle load (kg) rear	1070 (1040)	1100	1075 (1050)	1140 (1100)

Capacities

Fuel tank/reserve	Fuel	appr. ltr.	82/7[1])
Cooling system with heating	Water	appr. ltr.	16.8
Crankcase (without oil filter) max/min.	Engine oil	ltr.	6/4
Oil filter	Engine oil	appr. ltr.	0.5
Water pump	Hypoid oil SAE 90	cc.	10
Hydraulic clutch actuation	ATE blue brake fluid	appr. ltr.	0.05[2])
Mechanical transmission	Automatic Transmission Fluid	ltr.	1.4
Automatic transmission	Automatic Transmission Fluid	ltr.	5.75[3])
Rear axle	Hypoid oil SAE 90	ltr.	2.5[4])
Power-steering	Automatic Transmission Fluid	ltr.	1.5
Front wheel hub	Anti-friction bearing grease	(per hub) g	65—80
Brake system	ATE blue brake fluid	appr. ltr.	0.5

[1]) 2nd version, 1st version was 65/7 liters.
[2]) 0.1 liters on vehicles with internal clutch supply cylinder.
[3]) Applies to first filling only, for oil changes approx. 1 liter less.
[4]) Special oil for lock compensation differential with limited slippage.

Model	Sedan and Coupé		300 SE Sedan "Long"		Convertible	

Speeds, Consumption Figures, and Operating Conditions

Engine 1st Version and rear axle ratio i =	1 : 3.92[4])					
Maximum speeds (km/h) in the individual gears timed	autom. DB trans.	mech. trans.	autom. DB trans.	mech. trans.	autom. DB trans.	mech. trans.
1st gear	42		42		42	
2nd gear	74		74		74	
3rd gear	120		120		120	
4th gear	180[5])	180[5])	180[5])	185[5])	185[5])	185[5])
Climbing ability (%)						
1st gear	80[6])	80[6])	80[6])	80[6])	73[6])	77[6])
2nd gear	42	38	41	37	39	35
3rd gear	22.5	22	22	21.5	20.5	20
4th gear	12.2[7])	12.2	12	12	11.2	11.2
Engine 2nd Version and rear axle ratio i =	1 : 3.92					
Maximum speeds (km/h) in the individual gears timed						
1st gear	42		42		42	
2nd gear	74		74		74	
3rd gear	120		120		120	
4th gear	185[5])	190[5])	185[5])	190[5])	185[5])	190[5])
Climbing ability (%)						
1st gear	51.5	51.5	51	51	52	52
2nd gear	42	38	41	37	39	35
3rd gear	22.5	22	22	21.5	20.5	20
4th gear	12.2	12.2	12	12	11.2	11.2
Engine 2nd Version and rear axle ratio i =	1 : 3.75					
Maximum speeds (km/h) in the individual gears timed						
1st gear	44		44		44	
2nd gear	78		78		78	
3rd gear	124		124		124	
4th gear	195[5])	200[5])	195[5])	200[5])	195[5])	200[5])
Climbing ability (%)						
1st gear	51.5	51.5	51	51	52	52
2nd gear	40	36	38.5	34.5	36.5	32.5
3rd gear	21	20.5	20.5	20	19.5	19
4th gear	11.2	11.2	11	10.8	10.2	10.2
Acceleration time from 0—100 km/h in shift position "4" with kickdown	1st vers. = 11.5[8]); 2nd vers. (with R. A. 1 : 3.92) = 11.2					
Engine speed at 100 km/h in 4th gear (rpm)	1st vers. = 3320; 2nd vers. with R. A. 1 : 3.92 = 3215 2nd vers. with R. A. 1 : 3.75 = 3075					
Fuel consumption Consumption for average highway travel (ltr./100 km)	11—16				11.5—16.5	
Fuel consumption according to DIN 70030[2]) (ltr./100 km) — with automatic DB transmission	1st vers. = 13; 2nd vers. with R. A. 1 : 3.92 = 12.5 2nd vers. with R. A. 1 : 3.75 = 11.8 timed at 110 km/h					
Fuel consumption according to DIN 70030[2]) (ltr./100 km) — with mech. transmission	1st vers. = 14.5; 2nd vers. with R. A. 1 : 3.92 = 13.7 2nd vers. with R. A. 1 : 3.75 = 13.0 timed at 110 km/h					
Engine oil consumption (ltr./100 km)	0.15[9])					
Cooling water working temperature (° C)	70—95					
Fuel	Premium or benzol-gasoline mixture					
Antiknock rating (minimum ROZ) — for maximum output[3])	96					
Antiknock rating (minimum ROZ) — with maximum retardation of ignition involving a loss of performance	90					

[1]) Vehicle carrying 2 persons.
[2]) Determined at 3/4 of the maximum speed, at a maximum of 110 km/h with a 10 % increase.
[3]) The gasoline engines are adjusted at our works with commercial fuels to maximum output. If it should be necessary for a limited period of time to use fuels with an anti-knock rating below that given for maximum output the ignition must be retarded accordingly in all cases.
[4]) 3rd version. 1st version was 1 :4.10; 2nd version was 1 :4.08.
[5]) With super sports-type tires.
[6]) Theoretical value; cannot be obtained during normal operation, owing to road holding.
[7]) On Model 300 SE Coupé 12.5%.
[8]) On vehicles with mechanical transmission in 4th gear from 20—100 km/h = 21.5 sec.
[9]) During fast freeway driving the oil consumption may increase up to 0.3 ltr./100 km.

Job No.
0-6

Jacking up the Car

A. Jacking up at the Front Axle

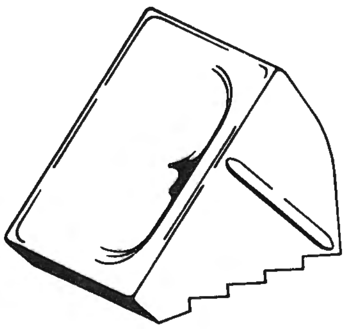
When the car is jacked up at the front axle by means of a shop lifting jack, a rubber pad about 150 × 150 mm square and 10 mm thick must be placed between the front axle support and the jack. This is necessary since otherwise there is a danger that the edges of the jack may damage the front axle support.
Place the stands at the left and the right under the chassis base panel near the lateral support tubes for the jack of the car.
Under no circumstances should the car be jacked up under the first cross member of the chassis base panel below the radiator block.

B. Jacking up at the Rear Axle

If the car is jacked up at the rear axle, place the shop lifting jack as usual under the center of the rear axle housing.
Place the stands at the left and right under the chassis base panel near the lateral support tubes for the jack of the car.

C. Jacking up with the Jack of the Car

Support tubes are provided at the front and at the rear on the chassis base panel on both sides for jacking up the car with the standard car jack. When the car is lifted at the front or at the rear both wheels are lifted off the road and it is therefore advisable, especially when the car is standing on steep grades, to put a chock under the wheel on the opposite side (Fig. 0-6/1).



Z-1287

Fig. 0-6/1

A chock can be supplied ex works as optional equipment.

C. Maintenance Jobs

Item		Job	Plan A after 300 m	Plan B after 2000 m	Plan C every 2000 m	Plan D every 6000 m	Plan E every 12000 m	Spring and Autumn Inspection
Cylinder head		Retighten bolts with engine warm	all					
Oil sump with aut. DB transm.		Retighten bolts	all with aut. DB transm.					
Engine cooling with heater system		Check hose clips in engine compartment for tight seat	all					
Hand brake		Check adjustment		all				
All V-belts		Check for tension and retighten, if requ.	all	all	all	all	all	
Vehicle wheels and tires		Check for external damage, sight check and interchange, if required. With winter tires change only front wheels right against left. Balance, if possible.			all	all	all	
Tires		Correct tire pressure	all	all	all	all	all	
Oil bath air filter		Check oil qty. and renew, if required clean insert in cover	diesel only	diesel only	diesel only	diesel only	diesel only	
Air filter		Clean paper element				all exc. diesel	all exc. diesel	
Spark plugs	Standard plugs	Clean, adjust electrodes		all std. plugs		all std. plugs		
		Replace					all std. plugs	
	Platinum plugs	Check electrode gap, realign, if required, or exchange plugs					all plat. plugs	
Distributor		Adjust points with closing cam angle meter, firing point with scintillation stroboscope				all	all	
		Check points for burns, replace, if required; grease distributor cams slightly, replace grease reserve at point rubbing block (special grease); moisten felt in cam bore with oil, fill lubricator with engine oil					all	
Engine		Adjust idling speed		all		all	all	
		Adjust valve clearance (with engine cold)	all				all	
Clutch		Check free travel on slave cylinder and adjust, if requ.	all w. mech. gearbox			all w. mech. gearbox	all w. mech. gearbox	
Hand and pedal brake		Adjust				all exc. 300 SE	all exc. 300 SE	
Pedal brake		Pull out linings, check thickness				all	all	
	Disk brakes	Pull out linings, check dust sleeves for burns, brittleness or moisture from brake fluid (leaky brake cyl.), remove calipers, if requ. Change dust sleeves and seales					all	
	Drum brakes	Check thickness of brake linings, remove linings, check brake drums and smooth down with emery, remove accumulated dust, check wheel brake cylinders for leaks, check dust caps for condition					all exc. 300 SE	
Hand brake cables		Check for wear					all	
Pedal and hand brake, clutch w. mech. gearbox, aut. DB transmission		Check for function and operation, (test drive, if requ.)		all		all	all	
All lines conn. hoses on engine and vehicle		Check for leaks, scuff marks, dents, shifting and corrosion	all	all		all	all	
Electrical system		Check all consumers for function				all	all	
Fuel filter	Main filter	Check flow and clean elements, if required					diesel only	
	Prefilter	Clean filter bowl, wire screen, base and sealing ring; check seat of filter bowl for leaks						diesel only
	Fine filter	Replace paper element (only every 24000 miles)					gas. inj. only	
Control linkage between mixture controller and injection pump		Check arrangement (after setting valves)					gas. inj. only	

Lubrication and Maintenance Jobs

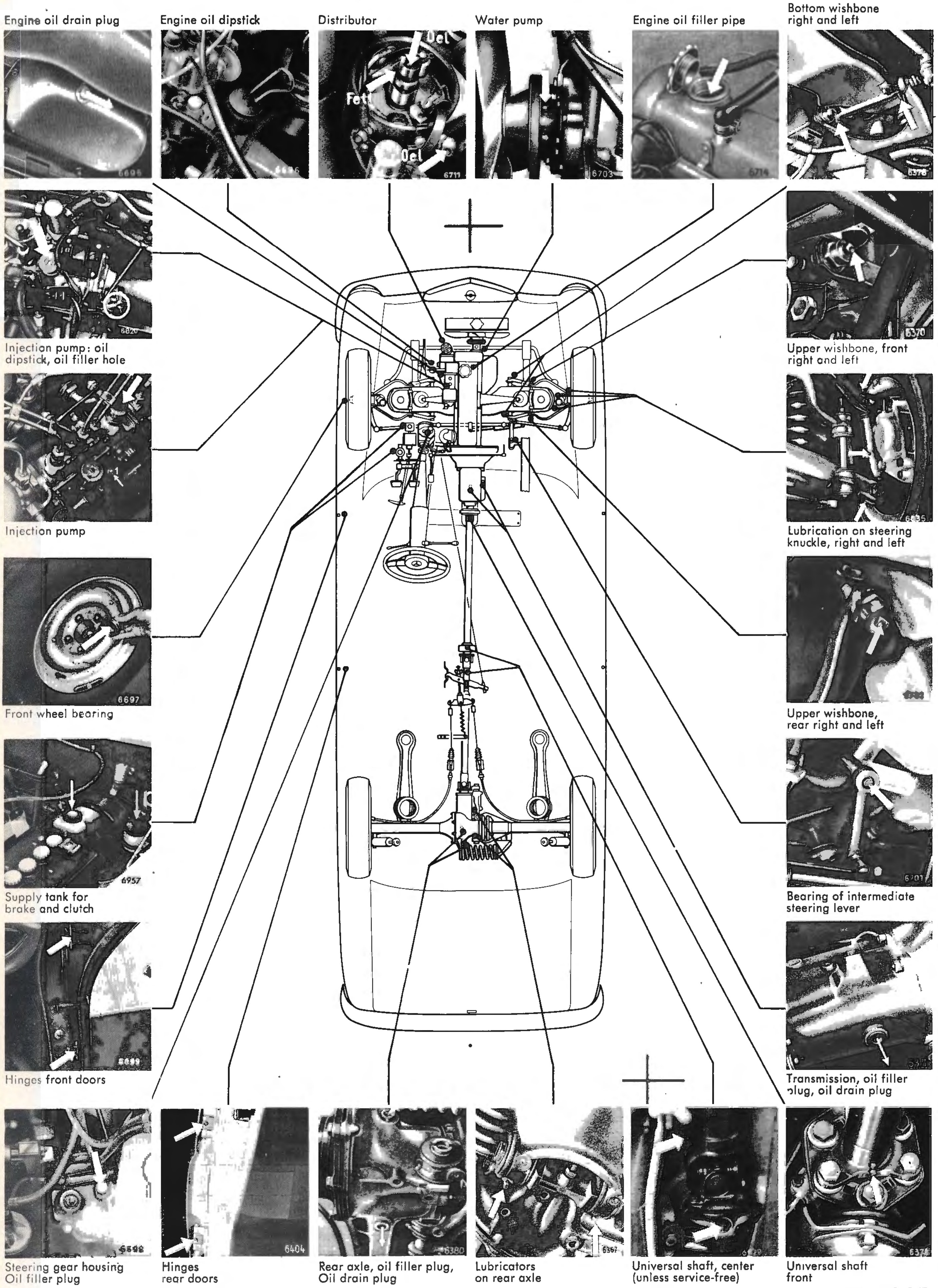
Job. No.
0-9

A. Lubrication Jobs

Item	Job	Plan A after 300 m	Plan B after 2000 m	Plan C every 2000 m	Plan D every 6000 m	Plan E every 12000 m	Spring and Autumn Inspection
Engine	Check oil level and top up, if requ.		all, exc. diesel	all, exc. diesel			
	Oil change	all	diesel only	diesel only	all	all	
Engine-oil filter	Clean main flow insert, replace by-pass cartridges	diesel only[1])			diesel only	diesel only	
	Replace paper element	gas. eng. only			gas. eng. only	gas. eng. only	
Aut. DB Transmission DB Power Steering	Check oil level and top up, if requ.	all with out. DB transm. or DB power steering	all with out. DB transm. or DB power steering	all with out. DB transm. or DB power steering			
Aut. DB Transmission	Oil change with oil at op. temp.					all	
Front axle, steering knuckle, int steering arm, universal shaft, rear axle susp.	Apply grease gun to lubricators		all	all	all	all	
Supply tank for brake and clutch op.	Check brake fluid level, top up, if requ. (If fluid loss is large, check system for leaks)	all	all	all	all	all	
Windshield washer	Refill container	all	all	all	all	all	
Battery	Top up w. dist. water	all	all	all	all	all	
Radiator	Top up w. coolant	all	all	all	all	all	
Supply tank of air suspension system	Drain condensate (Pull drain cock 1–2 secs.)		300 SE only	300 SE only	300 SE only	300 SE only	
Anti-freeze unit of air suspension system	At temp. below + 5° C fill with ethyl alcohol (96%) up to level of knurl, or spirit, in an emergency.		300 SE only	300 SE only	300 SE only	300 SE only	
Non-return throttle valve in choke	Check for easy running, lubricate				diesel only	diesel only	
Heater flap shaft in exhaust manifold	Check for easy running, spray with solvent, e. g. Karamba, if required				Carb. eng. only	Carb. eng. only	
Hand brake intermediate lever	Grease guideway				all	all	
Manual gearbox	Oil change (with oil at op. temp.)	all				all	
Rear axle housing	Oil change (with oil at op. temp.)					all	
Water pump, steering gear housing (standard)	Check oil level, top up, if requ.					all	
Door hinges	Apply grease gun to lubricators					all	
Front wheel bearings	Renew grease in wheel caps					all	
Injection pump	Check oil level and refill, if required (on diesel, operate fuel feed pump several times manually)	on diesel and gasoline inj. engines					
Hand brake lever, Bolt of hand brake comp. lever, Joints and bearing points of steering column shift, Gas lever shaft, Joints of cable levers and bearings of linkages to carburetor, or inj. pump on diesel and gasoline inj. engines and to choke, Hinges, spring bearings and joints for spring lever on engine hood and trunk lid, bowden wire and safety hook of engine hood, hinges (with flap closed only) and cable end of fresh air flap, hinges on flap to fuel filler pipe and pins of door hinges	Lubricate with a few drops of engine oil					all	
Lock and snap hook of engine hood	Check for easy running, grease lightly					all	all
Door locks	Grease slide surfaces of catches slightly, clean taper and grease again slightly					all	all
Trunk lid lock	Grease slide surface slightly						all
Door holder	Grease						all
Seat rails	Clean and grease						all

[1]) After 300 miles of driving, acc. to Plan A, exchange fine filter element installed in factory against specified main flow and by-pass elements.

B. Lubrication Chart



Item	Job	Plan A after 300 m	Plan B after 2000 m	Plan C every 2000 m	Plan D every 6000 m	Plan E every 12 000 m	Spring and Autumn Inspection
Shift linkage, gas linkage (aut. DB transmission)	Check: adjustment of gas linkage and kickdown, with vehicle standing on its four wheels (not jacked up)					all with aut. DB transm.	
Front axle	Check toe-in and camber	all				all	
Rear axle	Check camber					all	
Engine and servo units, transmission, rear axle, steering, radiator, main brake cyl. and clutch cylinder	Check for leaks, scuff marks, dents and corrosion	all				all	
Pedal system	Check for piston rod play on clutch master cylinder and main brake cylinder	all				all	
Steering linkage	Check seals of ball heads					all	
Shock absorbers	Check for leaks					all	
Universal shaft	Check joint plate					all	
Steering	Check steering coupling, check steering for play					all	
Engine	Check bolts and nuts for tight seat		all			all	
Front axle, rear axle, steering and body	Check bolts and nuts for tight seat					all	all
Track rods, steering shaft and steering damper	Sight check of nuts and lock washers						all
Slide roof (optional)	Check rails for tight seat, tighten, clean rails-grease slightly with vaseline, clean water drain pipe						all with slide roof
Fuel pump, fuel tank	Drain water and dirt, clean strainer						all
Cooling water areas, radiators	Flush, check for leaks, fill in treated water — antifreeze during frosty weather — Install winter thermostat or normal, as requ.						all
Venting and heating system	Check control valves for easy operation. Replace plastic filter, if required.						all
Preheater for intake air on air filter	Switch on or off						all carb. engines
Battery	Check acid level for acid density and terminals for good seat, grease (acid-proof grease)						all
Cable set, bulbs, lights	Check for scuff marks or condition						all
Ignition system	Check (incl. ignition cable and plugs)						all
Headlights	Check aiming		all exc. 300 SE				all
Door rim, sealing of trunk lid	Clean; coat seal with Orel						all
Molding on trunk lid hinge, wheel housing, spare wheel recess	Clean water drains						all
Frame floor, brake lines	Check for corrosion damage, apply underfloor protection as specified						all
Roadster or cabriolet top	Check condition of impregnation, re-impregnate, if required						roadster or cabriolet only
Vehicle wheels	Check for damage, derust (remove outer covers)						all

Engine - Group 00

Job No.
00-0

Engine

Checking and Adjusting Operations

*Modification: Model 230 SL added. Other modifications marked **

Tappet Clearance

Model		190 Dc[1])	190 c, 220 b[2]) 220 Sb, 220 SEb	230 SL	300 SE[3])
Tappet clearance with engine cold	inlet	0.15	0.08	0.08	0.10
	exhaust	0.35	0.15	0.18	0.20

[1]) On Model 190 Dc the tappet clearance is measured between the rocker arm and the valve shaft end or the cap nut (Fig. 00-3/5).
[2]) On Models 190 c, 220 b, 220 Sb, 220 SEb, and 230 SL the tappet clearance is measured between the sliding surface of the rocker arm and the cam base circle of the camshaft (Fig. 00-3/1).
[3]) On Model 300 SE the tappet clearance is measured between the valve shaft end and the adjustment screw or the ball socket (Fig. 00-3/6).

Compression

Model		190 Dc	190 c, 220 b, 220 Sb 220 SEb		230 SL	300 SE
Compression ratio ε		21 : 1	8.7 : 1	7.0 : 1	9.3 : 1	8.7 : 1
Compression in atm[1])	standard	22—24	10—11	7.5—8.5	10—11	11—12
	minimum	appr. 17	appr. 8.5	appr. 6	appr. 8.5	appr. 9.0

[1]) The compression should be measured at normal working temperature (cooling water temperature 70—80° C) and with the throttle valve open. Turn the engine at least 8 times with the starter. **The deviation between the individual cylinders should not exceed a maximum of 1.5 atm.**

Distributor Contact Caps and Closure Angle of Distributor

Model	190 c	220 b, 220 Sb 220 SEb, 230 SL	300 SE
Distributor contact gaps	0.4—0.5	0.3—0.4	0.35—0.45
Closure angle[1])	50°±3°	36°±2°	49°±2°[2])

Note: To counteract possible shrinking of the fiber block in the case of new distributor contacts, adjust the closure angle as far near the lower tolerance limit as possible. The distributor cams or the fiber block are worn if the closure angle is correct and the distributor contact gap is too small.

[1]) If the speed is increased to n = 4000 rpm, the permissible tolerance is — (minus) 3°.
[2]) The check should be made separately for both associated pairs. To do this, make inoperative one of the two associated pairs by inserting a fiber sheet.

Ignition Setting

a) Basic Setting or Assembly Setting for Installing the Distributor

Model	Compression ratio ε	Distributor Bosch designation	Basic setting[1])	
			Timing light check for ± 1° break gap	Stroboscope check at starter speed and with spark plugs installed
190 c	8.7 : 1	VJUR 4 BR 27 T	2° BTDC	3° BTDC
	7.0 : 1	VJUR 4 BR 28 T	3° BTDC	4° BTDC
* 220 b	8.7 : 1	VJUR 6 BR 47 T	2° ATDC[2])	TDC[2])
	7.0 : 1		2° BTDC[2])	4° BTDC[2])
* 220 Sb	8.7 : 1		2° ATDC[2])	TDC[2])
	7.0 : 1		2° BTDC[2])	4° BTDC[2])
* 220 SEb	8.7 : 1	VJUR 6 BR 45 T	2° ATDC[2])	TDC[2])
		VJUR 6 BR 49 T	2° ATDC[2])	TDC[2])
		VJUR 6 BR 61 T	2° BTDC[2])	4° BTDC[2])
	7.0 : 1	VJUR 6 BR 45 T	2° BTDC[2])	4° BTDC[2])
		VJUR 6 BR 49 T	2° BTDC[2])	4° BTDC[2])
		VJUR 6 BR 61 T	6° BTDC[2])	8° BTDC[2])
230 SL	9.3 : 1	VJUR 6 BR 49	2° BTDC[2])	4° BTDC[2])
300 SE	8.7 : 1	ZV/PBUR 6 R 1	1° BTCD[2])	3° BTDC[2])

[1]) The timing light check is only used as an assembly setting for the installation of the distributor. For reasons of comparison and to eliminate errors in measurement, check cylinders 1 and 4 in the case of 4-cylinder engines and cylinders 1 and 6 in the case of 6-cylinder engines. The difference between the two values must not exceed 1.5°.
If checks are made with the stroboscope at starter speed, the basic adjustment values are 1—2° earlier than if gap checks are made with the timing light.

[2]) On models 220 b, 220 Sb, 220 SEb, 230 SL, and 300 SE the basic setting is used only as an assembly setting for the installation of the distributor.

* **For measuring the ignition setting on 6-cylinder engines, only the adjustment value at a definite engine speed without automatic vacuum control should be used (see following Table of Stroboscope Values).**
Please make sure that also at engine speeds 800 and 1500 the stroboscope values are within the limits given in the table.
On the 300 SE distributor with double contact breaker check both cylinder 1 and cylinder 6 for ignition setting (or angular displacement of sparks by 180°). The difference between the two values should not exceed 1.5° on the crankshaft. A change in the angular spark displacement does not change the closure angle value.

b) Stroboscope Values

Model	Compression ratio ε	Stroboscope values at engine speed at rpm under no load[3])					Start of automatic vacuum control of distributor under no load at engine speed rpm[4])
		800	1500	3000	4500	4500	
		with or without automatic vacuum control					
		with and without	without	without	without	with	
190 c	8.7 : 1	8—13°	22—27°	28—32°	37—41°	+ 11°±3	1000—1200
	7.0 : 1	3—8°	18—23°	37—41°	46—50°		
* 220 b	8.7 : 1	4—11°	18—23°	23—27°	**33°** [2])	+ 11°±2	1400—1600
	7.0 : 1	8—15°	22—27°	27—31°	**37°** [2])		
* 220 Sb	8.7 : 1	4—11°	18—23°	23—27°	**33°** [2])		1800—2000
	7.0 : 1	8—15°	22—27°	27—31°	**37°** [2])		
* 220 SEb	8.7 : 1	TDC[5])	11—15°	**26°** [2])	26°	+ 14°±3	800—1000
		0—3°[6])	11—15°	**26°** [2,6])	26°		
		4—7°[7])	15—19°	**26°** [2,7])	26°		
	7.0 : 1	4° BTDC[5])	15—19°	**30°** [2,5])	30°		
		4—7°[6])	15—19°	**30°** [2,6])	30°		
		8—11°[7])	19—23°	**30°** [2,7])	30°		
230 SL	9.3 : 1	4—7°	15—19°	**30°** [2])	30°		
* 300 SE	8.7 : 1	8—15°	21—26°	26°	**26°** [2])	+ 11°±2	800—1000

[2]) See note 2 on page 00-0/2.

[3]) On 4-cylinder engines, when setting the ignition to the stroboscope values, the distributor must be adjusted or fixed in such a way that the upper limit of the stroboscope values is reached.

[4]) The start of the automatic vacuum control can be changed by screwing the adjusting screw in or out in the vacuum box. The total adjustment range of the automatic vacuum control can be decreased or increased by screwing the pull rod in or out which connects the diaphragm in the vacuum box with the distributor plate.

[5]) In the case of Distributor VJUR 6 BR 45 T.

[6]) In the case of Distributor VJUR 6 BR 49 T.

[7]) In the case of Distributor VJUR 6 BR 61 T.

If in exceptional cases a fuel with an octane rating lower than 96-99 ROZ (F-1) has to be used **an Models 220 SEb and 300 SE,** the ignition must be retarded in order to adapt it to the fuel used. Resetting is only permissible within certain limits set out in the table below:

Fuel Octane Rating ROZ (F-1)	Ignition Setting	
	Stroboscope value without automatic vacuum control on Model 220 SEb at n=3000 rpm on Model 300 SE at n=4500 rpm*	Ignition retarding by means of the adjustment eccentric by scale graduations
93	24° BTDC*	1 graduation*
90	20° BTDC*	3 graduations*

Ignition is retarded at the distributor bearing by means of the adjustment eccentric. Adjustment by one graduation on the scale of the distributor bearing changes the ignition by 2° on the crankshaft. Ignition should be advanced again by means of the adjustment eccentric as soon as fuel of the specified octane rating is available (see Table on Stroboscope Values.)

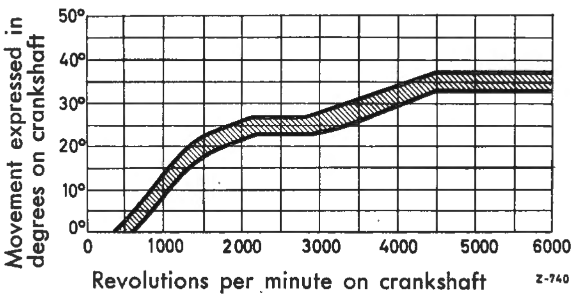
Whenever the eccentric is adjusted the hexagon screw (set screw) must be tightened again.

Distributor Movement Curves

Model 190 c

Distributor VJUR 4 BR 27 T

Automatic governor control movement



Automatic vacuum control movement

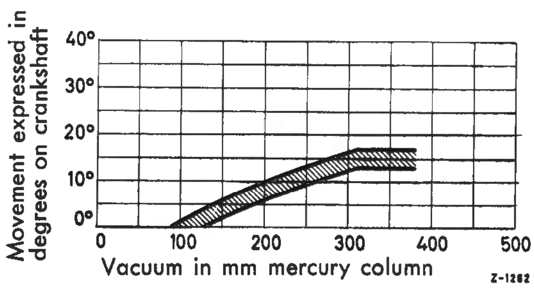
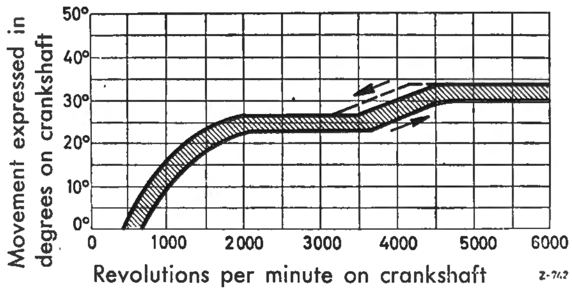


Fig. 00-0/1

Model 220 b, 220 Sb

Distributor VJUR 6 BR 47 T

Automatic governor control movement



Automatic vacuum control movement

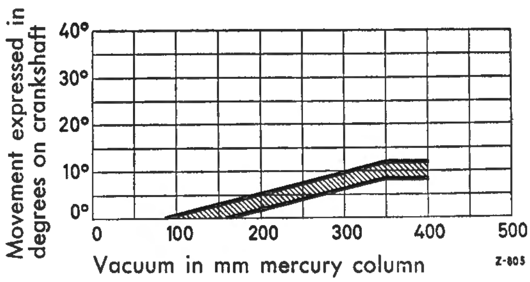
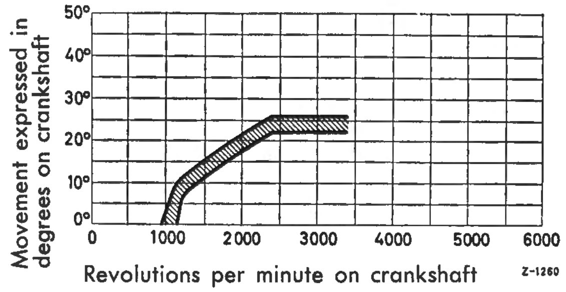


Fig. 00-0/2

Model 220 SEb (1st Version)

Distributor VJUR 6 BR 45 T

Automatic governor control movement



Automatic vacuum control movement

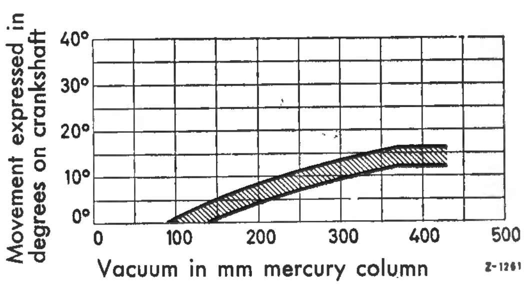


Fig. 00-0/3

Model 220 SEb (2nd Version)

Distributor VJUR 6 BR 49 T

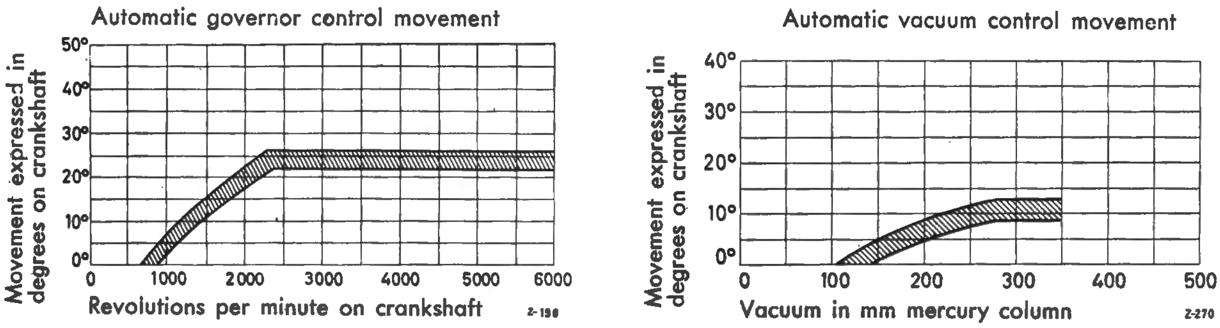


Fig. 00-0/4

* Model 220 SEb (3rd Version)

Distributor VJUR BR 61 T

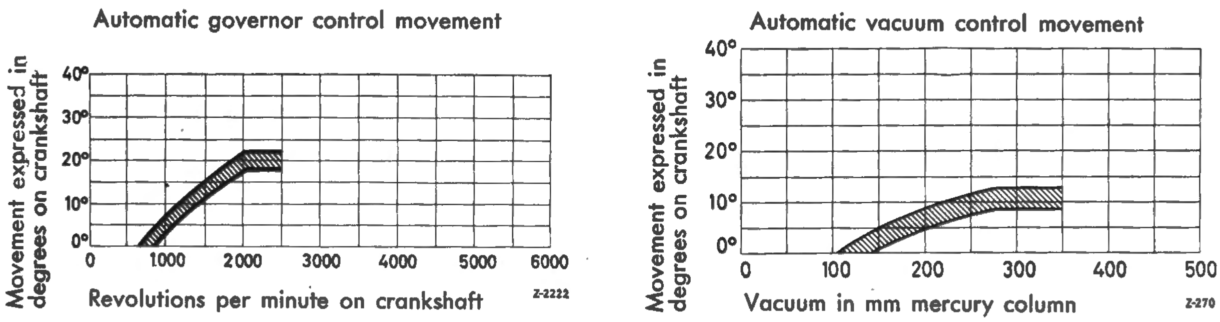


Fig. 00-0/5

Model 300 SE

Distributor ZVI/PBUR 6 R 1

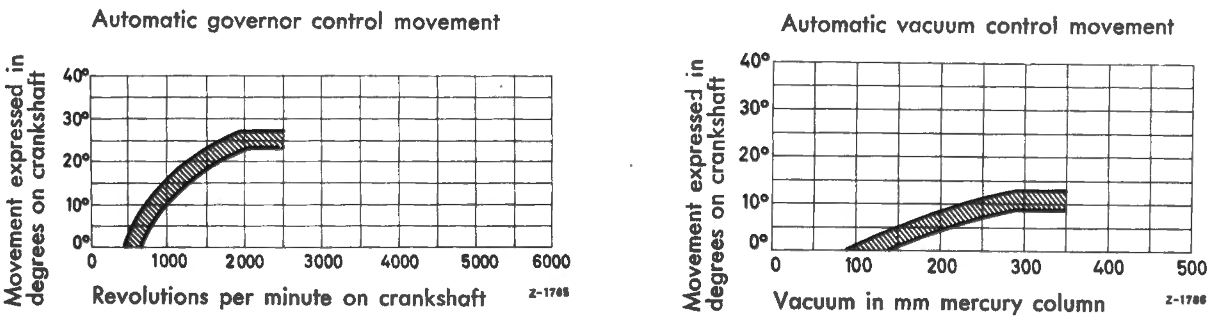


Fig. 00-0/6

Spark Plugs

For electrode gap, length of thread, list of approved spark plugs, etc., see Spark Plug Table in the pocket of the back cover of the "Tabellenbuch". For interpretation of spark plug appearance see Workshop Manual Model 190.

Position of Crankshaft for Installation of Injection Pump

Model	Position of crankshaft for installation of injection pump	
	with pump set to beginning of delivery stroke[1])	with pump set to end of delivery stroke[1])
190 Dc	26° BTDC on compression stroke	—
220 SEb, 300 SE	—	TDC[2])
230 SL	—	20° ATDC on suction stroke[3])

Beginning of Delivery Stroke in Relation to Crankshaft

On Model 190 Dc check and adjust the beginning of the delivery stroke after installing the pump by means of container and overflow pipe.

[1]) The injection pump is set to end or beginning of delivery stroke when the line mark on the injection pump camshaft is indexed with the line mark on the flange of the injection pump.

[2]) On Models 220 SEb and 300 SE it is of no importance whether the piston of the first cylinder is at the intersection dead center or at the ignition dead center. Fine adjustment with container and overflow pipe is not necessary.

* [3]) On Model 230 SL the injection pipe arrangement is the reverse of the previous arrangement, i. e. the injection pipe from pump element 1 of the injection pump goes to injection valve 6 of the engine, pump element 2 to injection valve 5, etc.

Caution: As a result, the piston of **the 6th engine cylinder** should be positioned at **20° ATDC on the suction stroke** (1st cylinder 20° after ignition top dead center).

Modification: Zenith Carburetor added on page 00-0/8.

Details of the Carburetor and Adjustment Data

Model		190 c	220 b
Carburetor designation		Solex 34 PICB	2 × Solex 34 PICB
Air horn "K"		28	24
Main jet "Gg"		0145	0120
Air correcting jet "a"		170	200
Mixing tube "s"		49	44
Mixing tube holder (reserve)		5.5[1])	5.5[1])
Idle fuel jet "g"		50	50
Idle air jet "u"		1.5	1.0
Accelerating pump		No. 72 (neutral)	No. 72 (neutral)
Injection amount (cc/stroke)		1.0—1.2	0.9—1.2
Pump jet "Gp"		80	50
Injection tube		high (0.5 graded)	high (0.5 graded)
Pump diaphragm (see Fig. 00-0/7)	Bolt length (mm)	20.7—20.9	20.7—20.9
	Plate ϕ (mm)	22	22
Position of Cotter Pins in connecting rod to accelerating pump		a and f	a and f
		see Fig. 00-0/6	
Starter fuel jet "Gs"		180	180
Starter air bore in starter rotary slide valve (mm ϕ)		4.0	4.0[2])
Float needle valve		2[3])	1.5
Weight of float (nylon float) (g)		5.7	5.7
Fuel level (mm)		17—19	17—19
Angle of throttle valve		8°	8°
Bypass bores (mm ϕ)		1.2 and 1.2	1.25
Stabilizing bore (mm ϕ)		1.5	1.5

[1]) With polyamide ball valve.
[2]) Up to Solex Carburetor No. 1822 855 starter air bore 5.5 mm ϕ. From Solex Carburetor No. 1581338 a starter rotary slide valve with a modified pressure spring has been installed (Part No. 000 071 15 30).
[3]) With cut-off tip.

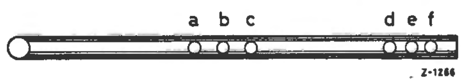


Fig. 00-0/6

Details of the Carburetor and Adjustment Data

Model 220 Sb

Carburetor designation	2 × Solex 34 PAITA		2 × Zenith 35/40 INAT	
Carburetor stage	I. Stage	II. Stage	I. Stage	II. Stage
Air horn "K"	23	27	23	27
Main jet "Gg"	0115[1])	135	0112.5	120
Air correction jet "a"	200	190 c with mixing tube	100	150
Mixing tube "s"	44	—	4 S	4 N
Mixing tube holder (reserve) with polyamide ball valve	5.5	—	—	—
Enriching jet	60[1])	—	—	—
Idle fuel jet "g"	50	—	0.45	0.50
Idle air jet "u"	1.4	—	—	—
Idle air bore (mm ∅)	1.5	—	1.5	1.0
Accelerating pump	No. 831 (neutral)		–	
Injection amount (cc/stroke)	1.3—1.7 (must not be corrected by adjusting the connecting rod)		0.8—1.2	—
Pump jet "G"	80		—	—
Injection tube	high (0.5 graded)		0.5 graded	—
Beginning of injection at opening of throttle valve	at once		5°	—
Pump diaphragm — Bolt length (mm)	18.7—18.9		—	
(see Fig. 00-0/8) — Plate ∅ (mm)	32[2])			
Beginning of full-load enrichment at throttle valve position	1°—4° after throttle valve of Stage II has begun to open[2])		—	
Starter fuel jet "Gs"	90[3]		—	
Starter air bore in starter rotary slide valve (mm ∅)	1.6[3]		—	
Float needle valve	2		2	
Float weight (float made of nylon) (g)	7.3		7.85	
Fuel level (mm)	19—21		—	
Float adjustment (mm)	—		18—20	
Adjustment of float chamber vent valve (mm)	—		1.5—2	
Fuel return valve adjustment (mm)	0.3—0.5		0.3—0.5	
Pilot throttle gap adjustment (mm)	—		2.6	
Automatic starting device stepped plate adjustment (mm)	—		5	

For footnotes see following page

[1]) The main jet "Gg" 0115 of the 1st stage and the enriching jet 60 (only for engines provided with the 2nd version of the carburetor intake scoop) have been installed as from engine end nos 10 004 842 and 11 000 019 (Solex Carburetor No. 4 413 611).

Up to engine end nos. 10 004 841 and 11 000 018 (Carburetor No. 4 413 610) only for engines with the 1st version of the intake scoop), the carburetor was equipped with a main jet "Gg" 0112.5 of the 1st stage and an enriching jet 50.

It is important that the carburetor jets should always correspond to the type of scoop installed; if this is not the case fuel consumption will be excessive or build-up will be faulty (see also Job Nos 09-0 and 09-1).

Before the enriching jet 60 was installed as a regular feature, a number of engines left our works with a 2nd version scoop and a 1st stage main jet "Gg" 0115. The larger enriching jet was not installed in these engines.

[2]) The pump diaphragm with a plate diameter of 32 mm and a full-load enrichment beginning at 1—4° after the initial opening of the 2nd stage throttle valve was installed as from engine end nos. 10 007 061 and 11 000 183 (Solex Carburetor No. 4 509 150).

Up to engine end nos. 10 007 060 and 11 000 182 (Solex Carburetor No. 4 509 149) the pump diaphragm had a diameter of 22 mm. In this case, full-load enrichment was adjusted to 65—70° throttle valve opening.

Carburetors can only be equipped with these new jets if the engine has a 2nd version scoop; in that case care should be taken to ensure that only pump diaphragms with bolts of the specified length are used (see Table).

[3]) As from Engine End Nos. 10 031 161 and 11 003 115 the starter fuel jet "Gs" 90 and the 1.6 mm ⌀ starter air bore in the starter rotary slide valve were installed to improve starting conditions in the half-starting position.

Up to Engine End Nos. 10 031 160 and 11 003 114 the carburetor was equipped with a starter fuel jet "Gs" 100 and a 3 mm ⌀ starter air bore in the starter rotary slide valve.

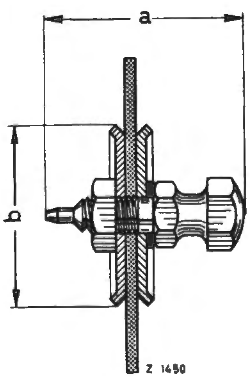


Fig. 00-0/7

Models 190 c, 220 b
Pump diaphragm

a Length of bolt
b Plate diameter

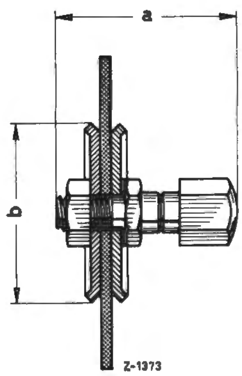


Fig. 00-0/8

Model 220 Sb
Pump diaphragm

a Length of bolt
b Plate diameter

Carburetor Altitude Adjustment

At high altitudes, due to the decrease in atmospheric pressure, carburetors equipped with standard jets supply too rich a mixture. To avoid this, install either Solex Altitude Correctors or smaller main jets in the carburetors. In the case of compound carburetors altitude correctors or smaller main jets are used only for the 1st stage.

a) Solex Altitude Correctors

The installation of the altitude correctors together with the standard main jets ensures that the engines are supplied with the correct fuel-to-air ratio at any altitude and any atmospheric pressure. The installation of the altitude corrector is recommended for cars that are driven both at normal and at high altitudes.
The aneroid compensator incorporated in the altitude corrector automatically regulates the fuel supplied to the main jet in relation to the atmospheric pressure obtaining at any altitude (Fig. 07-3/2).

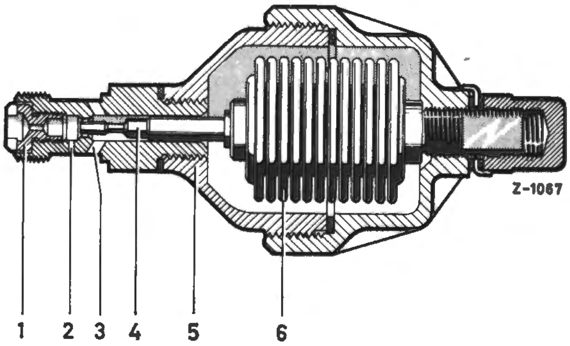


Fig. 00-0/9

1 Main jet
2 By-pass bore
3 Fuel intake bore
4 Needle
5 Housing
6 Capsule pack

Model	Solex altitude corrector		
	Part No.	By-pass bore	Main jet "Gg"
190 c	000 072 04 05	1.3 mm diameter	0145
220 b	000 072 03 05	1.0 mm diameter	0120
220 Sb	000 072 00 05	0.7 mm diameter	0115[1])

[1]) On Model 220 Sb the main jet "Gg" 0112.5 is installed up to Engine End Nos. -10-004 841 and -11-000 018 (1st version intake scoop 100 mm wide).

On this version the main jet "Gg" 0112.5 must be installed in the altitude corrector Part No. 000 072 00 05 on Model 220 Sb.

b) Smaller Main Jets

The guiding principle in altitude adjustment should be to choose the smallest possible main jet that ensures a minimum of performance loss. If the jet is too small or if the smaller jet is regularly used for driving at normal altitudes and at full load, there is a danger that the engine overheats because the carburetor supplies too rich a mixture.
The tables on carburetor jets and the table below give some indication of the size of the main jets for the various models.

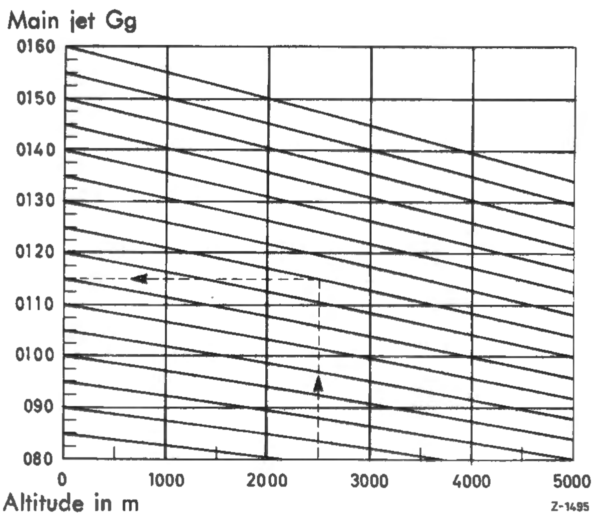


Fig. 00-0/10

Example:

Standard main jet: "Gg" 0125
Main jet at an altitude of 2,500 m:
"Gg" 0115
(see broken line)

Spray Pressure of Injection Nozzles and Injection Valves

Model	Bosch designation of injection nozzles and of injection valves	Spray or Opening Pressure in atm.	
		in the case of new injection nozzles or valves	in the case of used injection nozzles or valves: minimum
190 Dc	DNO SD 151	110—120[1])	100—120[1])*
220 SEb	EP/DES 5/45	14.5—15.5[2])	13.0—15.5[2])*
300 SE	EP/DES 3/60		
230 SL	DC 8 C 45 R 1	17.5—18.5[3])	15.0—18.5[3])

Note: If the injection system, nozzles and valves are checked or repaired, please contact the nearest Bosch agency if possible.

When removing the injection valves and distributor fittings mark the injection valves and distributor fittings in their proper order or put the two distributor groups into separate containers to avoid any possible confusion.

[1]) On Model 190 Dc the difference between the spray pressures of the jets of an engine must not exceed 5 atm.

[2]) On Models 220 SEb and 300 SE the difference in spray pressure between three injection valves belonging to a fuel distributor fitting (distributor group) **must not exceed 0.5 atm** in order to ensure that the fuel is evenly distributed to the various cylinders. To obtain the accurate measurements necessary, use testers with a pressure gage **of the 0—25kg/cm² range (see checking of injection valves page 00-15/4).**

If the difference exceeds 0.5 atm the injection valve or the whole distributor group with the defective injection valve must be replaced.

[3]) On Model 230 SL the difference between the spray pressure of the injection valves of any one engine must not exceed 3.0 atm.

Fuel Quantity Delivered by the Injection Valves of any one Distributor Group

The maximum difference in the fuel quantity delivered by the injection valves must not exceed 2.5 cm³/1000 strokes in the idle position (350 rpm of the injection pump). At full load (1000 rpm of the injection pump) it must not exceed 3.0 cm³/1000 strokes (see measurement of even fuel distribution of the distributor groups page 00-15/5).

On Models 200 SE and 220 SEb the cold-start quantity per unit should on an average be 11 to 13 cm³/100 strokes at 40 rpm of the injection pump, but must not be less than 8 cm³/100 strokes and on Modell 300 SE it should on an average be 14 to 16 cm³/100 strokes, but never less than 11 cm³/100 strokes (in the case of OL 61 v 1).

If the differences in the idle position and at full load are greater or if the cold start quantity as given above is not obtained, the whole distributor group must be replaced.

Correlation: Venturi Control Unit – Injektion Pump

Models 220 SEb, 230 SL, 300 SE

Throttle valve angle	Control angle
0° 2.5 5 7.5 10	0° 4—4.5 8—8.5 11.5—12.5 15.5—16.5
15 20 30 40	22.5—23.5 29—30 40.5—42 50.5—51.1
50 60 70 80—82	59—60 67—68 73.5—75 79—82

Engine vent nozzle ϕ

Model	Inside ϕ	Vent Nozzle or Bore installed
190 c	9.0	in threaded union on cylinder head cover
190 Dc	6.0	in pipe union of venturi control unit
220 b 220 Sb	6.5	in threaded union on cylinder head cover
220 SEb 230 SL	10.0	in pipe union of venturi control unit
300 SE	7.5	in threaded union on cylinder head cover

Exhaust-Gas Test Values

Model[1])	Exhaust-gas test values (percentage) according to Sun at engine speed rpm (no load) (applicable only to "Sun" Exhaust-Gas Tester)			
	800	1500	3000	4500
190 c	78—80	83—89		
220 b 220 Sb	77—79	77—82	80—86	83—89
220 SEb 230 SL 300 SE	79—81	78—82	[2])	[2])

Note: When the exhaust-gas test is made, both the cooling water and the oil temperature should be appr. 80° C.

[1]) The exhaust-gas test values for Model 190 Dc are listed in Workshop Manual OM Diesel Engines Untertürkheim Production, page 07-8/5.

[2]) For the adjustment of the injection engines the exhaust-gas test values at 3000 rpm and 4500 rpm are not required.

Intake Pipe Vacuum Values

measured at carburetor or intake pipe

Model	Intake pipe vacuum in mm Hg at engine speed rpm (no load)				
	at starter speed[1])	800	1500	3000	4500
190 c	250—350	470—520	510—560	510—560	480—530
220 b	150—250	440—490	500—550	510—560	480—530
220 Sb		430—490			490—540
220 SEb		440—490	450—500	—	—
230 SL		370—420		—	—
300 SE		440—490		—	—

Note: When measuring the intake pipe vacuum, make sure that both cooling water and oil temperature of the engine are definitely above 80° C.
On Models 190 c, 220 b and 220 Sb,
operation with one cylinder at initial speed n=2500 rpm,
operation with two associated cylinders at initial speed n=1500 rpm,
Permissible difference between associated cylinder pairs: 100 rpm, vacuum appr. 50 mm Hg. Each individual cylinder should turn the engine as evenly as possible.

[1]) and with throttle or control valve completely closed (no leak at flanges, shafts, intake pipe, pistons and valves).

Engine Speed Ranges

Model	Idling speed rpm	Engine speed rpm at maximum engine performance HP	Permissible maximum speed in the individual gears rpm
190 c	750—800	5000/80	6000
220 b		4800/95	
220 Sb		5000/110	
220 SEb	700—800[2])	4800/120	
230 SL	700—800[3])	5500/150	6500
300 SE	650—700[4])	5000/160	6000

[1]) For adjustment of idle and carburetor linkage see Workshop Manual Passenger Car Models starting August 1959, Volume 1, pages 00-16/9 to 00-16/12 and pages 00-13/1 to 00-13/4.

[2]) 680—720 rpm with automatic transmission and an injection pump ZEA-R 7 or ZEB-R 13.

[3]) 800—850 rpm with non-automatic transmission.

[4]) 620—700 rpm with the gear engaged, not below 600 rpm with the gear engaged and the steering at full lock.

Model	Idling speed rpm[5])	Full load maximum speed or beginning of governing rpm	Maximum speed, no load or end of governing rpm
190 Dc	700—800	4350	5000—5200

[5]) For adjustment of idling speed see Workshop Manual OM Diesel Engines Untertürkheim Production, pages 00-11/1 and 00-11/2.

Fuel Feed Pump

Model		190 c, 220 b, 220 Sb	190 Dc
Pump designation		—	Bosch FP/K 22 M 2/8
Delivery pressure	Measuring point	behind pump outlet	
	Delivery pressure at starter speed atm	0.12—0.16	—
	Delivery pressure at idling speed atm	0.15—0.20	0.8—1.5
Vacuum	Measuring point	in front of pump inlet	
	Vacuum at starter speed atm	0.3—0.4	
	Vacuum at starter speed mm Hg	230—320	
Suction head m		0.9	
Clearance between cam and tappet mm		0.4—0.5	--

Fuel Feed Pumps

Models 220 SEb, 230 SL, 300 SE

Pump designation		Bosch electric fuel feed pump FP/ESB 5 RC 25/12/1 FP/ESB 5 RC 25/12 A 1
Delivery pressure	Measuring instruction	with the engine not running and with new fine filter element
	Measuring point	behind fine filter
	Minimum delivery pressure atm	0.4
	with a minimum terminal voltage at the feed pump[1]) volts	10
	Input of fuel feed pump[1])	3.1—4.0*
Output [1, 2])	Measuring instruction	with the engine not running
	Measuring point	behind return-line damper unit
	Minimum delivery in ltr./min.	3.3*

[1]) The terminal voltage and the current input for measuring the delivery pressure apply also when measuring the pump output.
* [2]) When measuring the output, the fuel tank should be at least half full.

Opening Pressure of Fuel Overflow Valve

On Model 190 Dc = 1 to 1.5 atm

On Models 220 b, 220 Sb, 220 SEb and 300 SE no overflow valve has been installed whereas on Models 220 SEb and 300 SE the bore in the threaded union on the inlet side of the damper unit in the return pipe, and on Model 230 SL the bore in the threaded union of the return pipe act at the same time as a throttle.

Tightening torques in mkg

Model		190 Dc	190 c 220 b 220 Sb	220 SEb 230 SL	300 SE
Cylinder head screws	with engine cold[1])	9	8		10[3])
	with engine hot[2])	9	9		11[3])
Hexagon socket screws M 10 for camshaft bearings		—			4
Threaded bolt in cylinder heat for rocker arm mounting		—	10		—
Threaded bolt in cylinder heard for rocker arm mounting		—	minimum 1.5		—
Rocker arm block screws[4])		3.75	—		3.75
Spark plugs		—	3—3.5		
Glow plugs		5	—		
Precombustion chamber in cylinder head		15	—		
Nozzle in nozzle holder		7—8	—		
Nozzle holder in cylinder head		7—8	—		
Nut for connector on nozzle holder		7	—		
Hexagon nut for fastening spray adjustor to drive shaft of injection pump		7	—		
Hexagon nut for fastening injection nozzle flange		—		0.8+0.2 [5])	
* Injection nozzle in cylinder head		—		[5])	—
* Pipe union for pressure valve on injection pump[6])		4.5+0.5	—	4.5+0.5	
Cap nuts of injection pipes		2.5	—	2.5	
* Connecting rod bearing bolts[7])		3.75 mkg			
* Crankshaft bearing bolts[8])		9	8 [9])		5±0.2
Shoulder screw or clamp nut on crankshaft, front		18			20
Fixing screws for Vee-pulley to vibration damper		—			2.5+0.5
* Nuts or screws for flywheel or driven plate on crankshaft		5.5+0.5 [10])			4±0.2
* Fixing screws for lower part of oil pan		0.8			
Fixing screws of engine supports on crankcase		6			4.5—0.5

Note: Torque wrenches should not be used above 50—75 p. c. off their capacity (e. g. for a 3.75 mkg tightening torque a torque wrench with a range of 0—6 mkg should be used).

Footnotes for Table Tightening Torques

1) Before fitting the cylinder head screws apply graphite oil (Auto-Kollag) to the threads and to the contact surfaces of the cylinder head screws and the washers.
The instructions for the tightening sequence and for the tightening stages of the cylinder head screws should be strictly adhered to (see Table for Tightening Sequence of Cylinder Head Screws on this page).

2) After installing the cylinder head, warm up the engine under slight load until the cooling water temperature reaches 80° C. Run the engine for approx. 5 minutes at this cooling water temperature and then tighten the cylinder head screws with the engine warm according to the values listed above.
As usual check the tightening torques again after the road test or after a mileage of no more than 20 km, with the same tightening torque as prescribed for the warm-engine check.
The instructions for tightening sequence and for tightening stages of the cylinder head screws should be strictly adhered to also for this operation (see Table for Tightening Sequence of Cylinder Head Screws on this page).

3) Cylinder head screws M 10 (Nos. 15 to 20) should be tightened to 5 mkg with the engine cold and to 6 mkg with the engine warm.

4) When tightening the rocker arm block screws, the rocker arms must not be under load from the camshaft.

5) On Model 230 SL the injection nozzle is screwed into the light-metal cylinder head with a tightening torque of 3—3.5 mkg.

6) In order to ensure proper seating of the sealing rings of the pipe unions, tighten the pipe unions to 4.5 mkg and back them out again, then tighten them to 4.5 mkg and back them out before finally tightening them to 4.5+0.5 mkg.

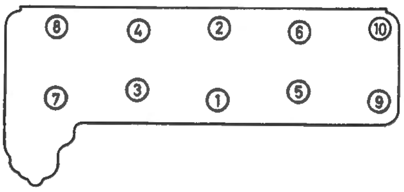
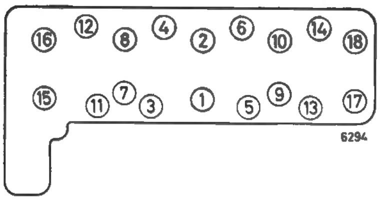
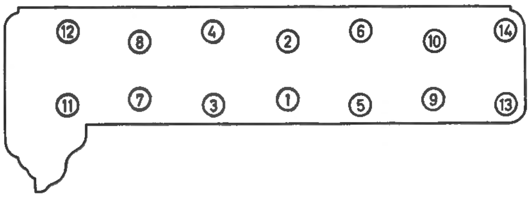
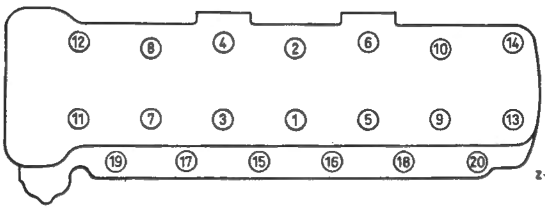
7) The connecting rod bearing bolts (without lock washers) are tightened with a torque of 3.75 to 3.80 mkg. Before tightening the bolts, liberally coat the threads of the bolts and the nuts with graphite oil or tallow.

8) The main bearing bolts are lightened without lock washers. On Model 300 SE with light-metal crankcase tighten the collar bolt for fastening the crankshaft bearing caps with a torque of 5 mkg if this bolt has to be screwed in.

9) On Model 190 c the crankshaft bearing bolts are tightened with a torque of 9 mkg.

10) When repairs are carried out use only 12 K stretch screws Part No. 621 032 00 71.
When a 10 K stretch screw is installed the tightening torque is 4.5+0.5.

Table for Tightening Sequence and Tightening Stages of Cylinder Head Sews M 12

Model	Diagram for tightening sequence of cylinder head screws	Tightening stages			
		1st tighten-ing mkg	2nd tighten-ing mkg	3rd tighten-ing mkg	check2)
190 c	 Z-673	4	6	8	9
190 Dc	 6294	3	6	8	8
220 b 220 Sb 220 SEb 230 SL	 Z-874	4	6	8	9
300 SE	 Z-727	M 12 screws 1 to 14			
		4	7	10	11
		M 10 screws 15 to 20			
		2	4	5	6

Note: The other screws with M 8 thead should be tightened by means of a hand wrench.
Slackening of the cylinder head screws is the reverse of the tightening procedure.

Removal and Installation of Engine together with Transmission

Job No. 00-1

Modification: Assembly Instructions for Cars with Power Steering and Air Suspension added

Removal:

1. Remove the hood.
   In the case of the 1st version hood attachment release the pressure on the torsion bar (1) on the hood with Removal Tool 111 589 02 61 (6) and remove the collar bolt (5) (Fig. 00-1/1).

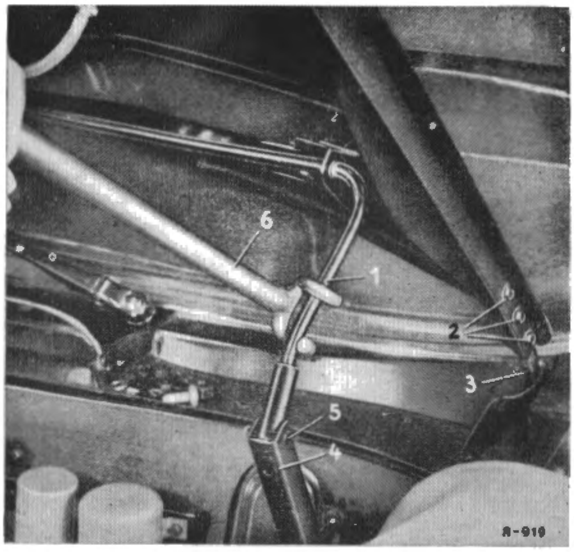


Fig. 00-1/1

1 Torsion bar	4 Lever
2 Hexagon screws	5 Collar bolt
3 Hinge	6 Removal Tool 111 589 02 61

2. Remove the battery, drain the cooling water and remove the radiator (see Job No. 50-1), disconnect the heating hoses. On cars with automatic transmission disconnect the connections at the oil cooler and close with dummy plugs.

3. On gasoline and diesel engines unscrew the air intake silencer. On injection engines remove the upper part of the air intake silencer.

4. Disconnect all fuel hoses and the vacuum hose to the power brake. On cars with power steering and air suspension disconnect oil hoses and air lines. Close the connections with dummy plugs.

5. Disconnect the hose for the oil pressure gage.

6. On gasoline engines disconnect the choke cable from the carburetor. On diesel engines disconnect the idle control cable and the start-stop cable. Detach the accelerator linkage.

7. Disconnect the ground cable from the battery to the engine and the ground cable from the engine to the car body. Disconnect all other electric cables.

8. Detach the gearshift linkage (Fig. 00-1/2).

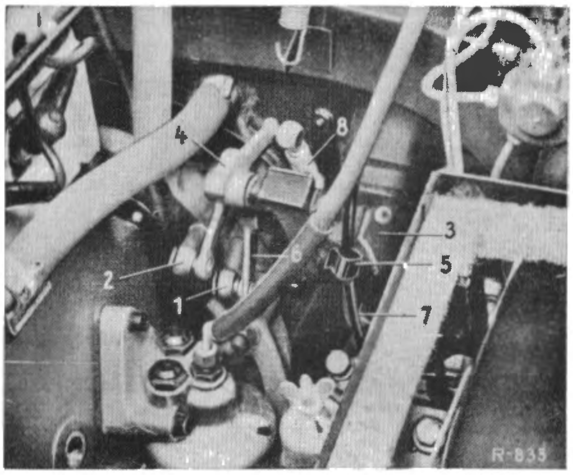


Fig. 00-1/2

1 Selector rod	5 Retaining clip
2 Shift rod	6 Selector lever
3 Cover	7 Flexible drive
4 Relay lever	8 Spring-loaded ball connector

9. Unscrew the exhaust pipes from the exhaust manifold.

10. Unscrew the bracket (4) for the exhaust pipe support from the mounting plate (9) on the transmission, loosen the clamping screw (7), and push the bracket downward (Fig. 00-1/3).

11. Pass a suitable lifting cable under the engine, at the front at the Vee-pulley and at the rear at the oil pan, and tighten the cable gently until it takes the weight (see Fig. 00-1/7).

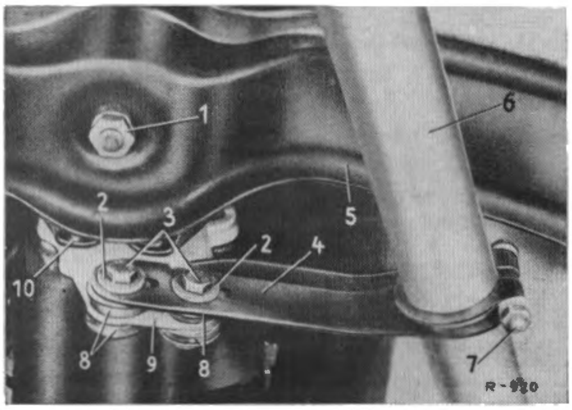


Fig. 00-1/3

1 Hexagon nut
2 Washer
3 Hexagon screw
4 Bracket for exhaust pipe
5 Support
6 Exhaust pipe
7 Hexagon screw (clamping screw)
8 Rubber washer
9 Mounting plate
10 Engine support

12. Mark the position of the rear support (12) in relation to the chassis base panel (20) and remove the support from the rubber mounting and the chassis base panel (Fig. 00-1/4).

    Detach the center brake cable from the brake lever and take it out of the cable guide of the front axle support and the support (12). Then remove the support (Fig. 00-1/4).

13. Unscrew the engine support with the rubber mounting from the transmission case rear cover. Disconnect the speedometer drive.

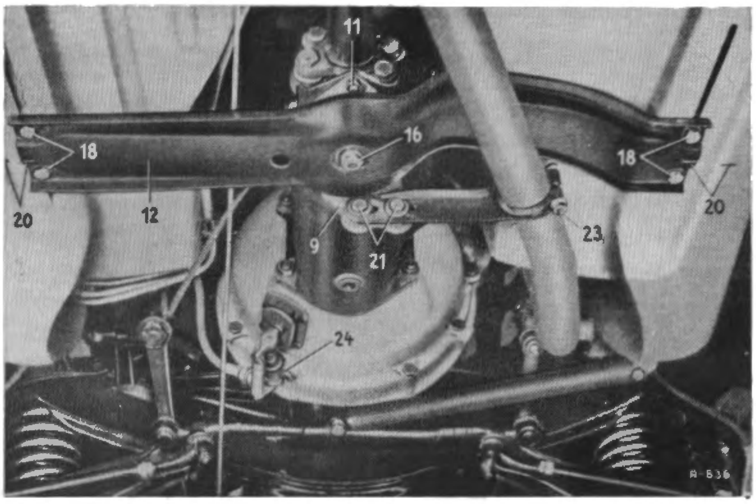
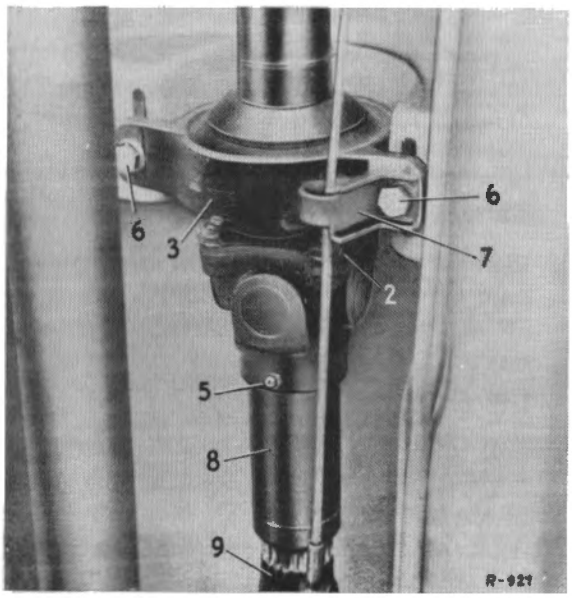


Fig. 00-1/4

9 Mounting plate
11 Rubber mounting
12 Rear support
16 Hexagon nut
18 Hexagon screw
20 Position markings
21 Hexagon screw
23 Hexagon screw
24 Extraction cylinder



14. Mark the position of the bearing bracket for the propeller shaft intermediate bearing on the chassis base panel.
    Then screw out the two fixing screws (6) together with washers (Fig. 00-1/5).

15. Disconnect the propeller shaft together with the shaft plate at the transmission and push to the rear.

Fig: 00-1/5

2 Joint flange of front propeller shaft
3 Bearing bracket
5 Grease fitting for slip coupling
6 Hexagon screws for fastening the bearing bracket to the chassis base panel
7 Cable bracket
8 Slip coupling with universal joint of rear propeller shaft
9 Rear propeller shaft

16. On cars with mechanical transmission detach the return spring (10) from the clutch throw-out fork (11) and the extraction cylinder (5). Then unscrew the extraction cylinder from the clutch housing and remove the pressure pin.

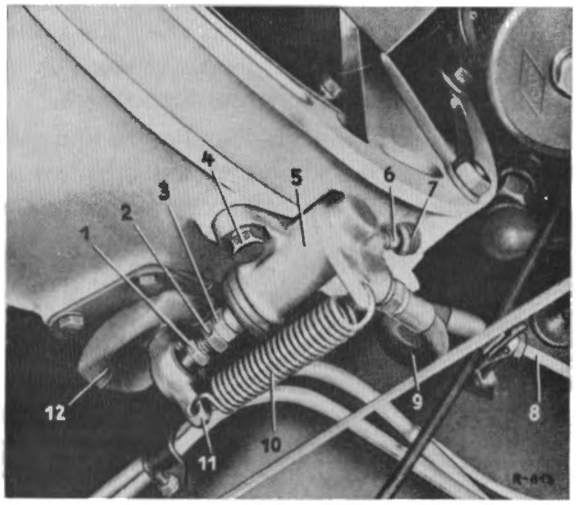


Fig. 00-1/6

1 Push rod	7 Protective cap
2 Hexagon nut	8 Line
3 Pressure pin	9 Hose
4 Hexagon screw	10 Return spring
5 Extraction cylinder	11 Throw-out fork
6 Bleed screw	12 Rubber cuff

17. Unscrew the hexagon screws at the front engine suspension at the left and right, holding the rubber mountings steady with an SW 22 Wrench (see Fig. 22-1/1).

18. Slightly raise the engine with the transmission with a hoisting rig and tilt it to an angle of appr. 45°. In this position lift out the engine with the transmission (Fig. 00-1/7).

Installation:

19. Lower the engine together with the transmission at an angle of appr. 45° until the transmission is behind the steering linkage. Then place a jack under the transmission and lower the engine at the front until it is seated on the engine mountings.

Note: The oil pan must not foul the steering linkage.

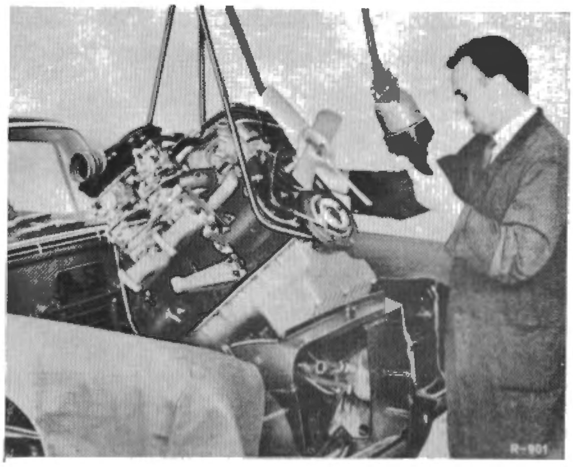


Fig. 00-1/7

20. Screw the hexagon screws for the front engine support at the left and the right into the engine mountings. Remember the spring washer.

21. Raise the jack under the transmission until the propeller shaft can be flanged to the transmission. Then place the sealing ring on the transmission main shaft, push the propeller shaft forward and flange it to the transmission. Cotter the castle nuts (see Job No. 26-1).

22. Connect the flexible speedometer drive.

23. Attach the propeller shaft intermediate bearing to the chassis base panel, noting the positions marked during removal.

24. Attach the mounting plate and the engine support to the transmission.
On Models 220 SEb Convertible and 300 SE Convertible adjust the limit stop at the rear engine mounting (see Job No. 24-1).

25. Screw the support to the rear engine mounting and to the chassis base panel, noting the positions marked during removal (see Fig. 00-1/4).

26. Adjust the limit stop at the rear engine mounting (see Job No. 24-1).

27. On cars with mechanical transmission attach the extraction cylinder to the clutch housing, installing at the same time the push rod between the pressure pin and the throw-out fork.

28. On cars with mechanical transmission adjust the clutch pedal free play (see Job No. 29-3).

29. Attach the gearshift linkage (see Fig. 00-1/2).

30. Check the adjustment of the steering-wheel gearshift mechanism (see Job No. 26-3).

31. Install the battery and connect all electric cables. When connecting the electric cables, pay attention to the color coding.

    a) **Cable connections to generator:**

    Connect the black cable of the regulator harness (1.5 mm² section) fitted with cable socket to terminal DF, the red cable (4 mm² section) to terminal D +, the brown cable (2.5 mm² section) to terminal D — of the generator.

Note: Be sure to connect cables to the correct terminals. Incorrect connection of the terminals involves the danger of pole reversal to the generator and could result in the destruction of the generator.

    b) **Cable connections to starter:**

    Connect the battery cable 30 and the red cable 51 to the terminal of the solenoid switch. Push the rubber cap over the terminal.
    Connect the black/red control cable to the solenoid switch by means of the slotted screw.

Note: The black/red control cable must not be passed through the rubber grommet at the starter terminal, since it might rub against the terminal for the battery cable 30 and 51 (see Job No. 15-1, Fig. 15-1/2). In this case the control cable might become live and operate the starter. The black/red control cable must therefore be wound around cables 30 and 51 and be connected directly to terminal 50.

    c) Fasten the car body ground cable to the upper fixing screw of the starter.

    d) Fasten the ground cable from the battery at the top behind the oil filter by means of the hexagon screw.

    e) Connect the ignition cable from the ignition coil, terminal 1, to the distributor.

    f) Connect the cables to the battery.

    g) On injection engines connect the cables to the cold-start magnet, the thermo switch and the thermo time switch.

    h) On cars with automatic transmission connect the cables to the oil pressure switch and the cable connector.

32. Screw the exhaust pipes to the exhaust manifolds with new gaskets. Tighten the hexagon screws and nuts evenly.

33. Screw the bracket of the exhaust pipe support to the mounting plate with the rubber washers, the cup washers, the sleeves, and the two hexagon screws with washers, lock washers, and hexagon nuts.

34. On cars with gasoline engines attach the choke cable to the carburetor.
    On cars with diesel engines attach the idle adjustment cable and the start-stop cable.

35. Install the radiator (see Job No. 50-1). Connect up the radiator thermometer and the water hose to the heat exchanger.

36. Install the air intake silencer.

37. Connect the fuel lines and the flexible hose of the oil gage line to the oil filter.
    On cars with power steering and air suspension connect oil hoses and air lines.

38. Install the engine hood. Check the engine hood for correct seating.

39. Fill up the cooling water.

40. Check the oil level in the engine and in the transmission, if necessary top up the oil.
    On cars with power steering check the oil level in the oil pressure pump reservoir.

41. Start the engine and check all unions for mechanical tightness and leakage and check the electrical system.

42. Check the cooling water level again and if necessary top up with water.

Power Unit Assemblies - Group 03

	Job No.
Removal and Installation of Counterweight and Vibration Damper on Crankshaft	03-10
A. Counterweight on Model 190 c	
B. Vibration Damper and Counterweight on Models 220 b, 220 Sb, 220 SEb, and 230 SL	
C. Vibration Damper on Model 300 SE	

Adjustment of Tappet Clearance

Modification: Adjustment on Models 190 c, 190 Dc and 300 SE (Addition)

Job No.
00-3

The tappet clearance should only be adjusted and checked with the engine cold.

On Models 190 c, 220 b, 220 Sb and 220 SEb the tappet clearance is measured between the sliding surface of the rocker arm and the cam base circle of the camshaft, on Model 300 SE between valve shaft end and adjusting screw or ball socket, on Model 190 Dc between rocker arm (6) and cap nut (7) (see Figs. 00-3/1, 4 and 6).

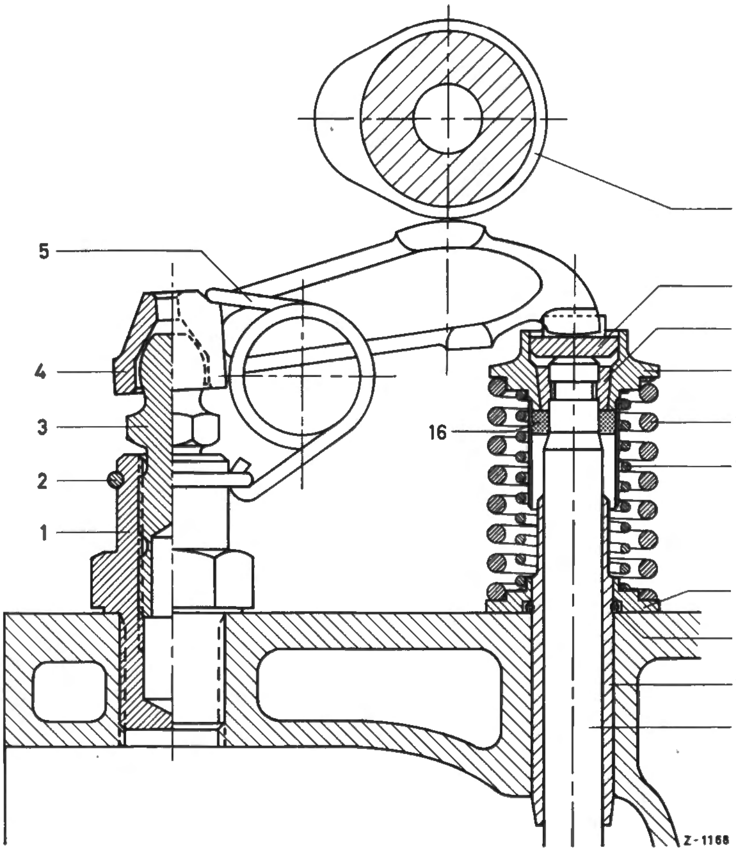


Fig. 00-3/1

Valve arrangement on Models 190 c, 220 b, 220 Sb and 220 SEb

1 Ball pin base
2 Annular spring
3 Ball pin head
4 Rocker arm
5 Spring clamp
6 Camshaft
7 Pressure piece
8 Valve cone half
9 Valve spring retainer and sealing ring retainer
10 Outer valve spring
11 Inner valve spring
12 Pressure piece
13 Snap ring
14 Valve guide
15 Valve
16 Sealing ring

1. Pull the ignition lead plugs off the spark plugs and pull the high tension cable out of the distributor plate.
   Detach the air vent line at the cylinder head cover and after loosening the tensioning screws remove the cylinder head cover.

Note: On Model 300 SE and on Model 220 SEb in the case of the 2nd version control the control shaft must be removed (see Job No. 00-16). In the case of gasoline engines the carburetor scoop must be removed as well.

2. Check the tightening torque of the cylinder head screws and if necessary tighten to specified value.
   The firing order is 1-5-3-6-2-4 in the case of the 6-cylinder-engines and 1-3-4-2 in the case of the 4-cylinder-engines, beginning with the first cylinder.

Position of inlet and exhaust valves

◁———————

Direction of travel

O O O O O O

E E E E E E

O O O O O O

1st 2nd 3rd 4th 5th 6th cylinder

Fig. 00-3/2

3. Move the cam of the camshaft which operates the tappet being adjusted to the position where the lobe of the cam is not pressed against the rocker arm but is on the opposite side and at right angles to the sliding surface of the rocker arm, i. e. the base circle of the cam faces the sliding surface of the rocker arm.

Screw out the spark plugs and turn the crankshaft at the shoulder screw fastening the Vee-pulley and the counter-weight to the crankshaft; use an SW 22 socket and a ratchet to turn the crankshaft in the direction in which the engine turns.

Note: In the case of Model 300 SE use a suitable length of round iron to turn the crankshaft. To do this 12 holes with 6 mm ⌀ have been bored at the circumference of the vibration damper plate.

4. To measure and adjust the tappet clearance insert the tolerance feeler band between the sliding surface of the rocker arm and the cam base circle on Models 190 c, 220 b, 220 Sb and 220 SEb, between valve shaft end and adjusting screw or ball socket on Model 300 SE, between rocker arm and cap nut on Model 190 Dc.

   The tappet clearance is adjusted correctly if the tolerance feeler band can only just be pulled through.

5. If a correction of the tappet clearance is necessary,
   a) on **Models 190c, 220b, 220Sb and 220SEb**

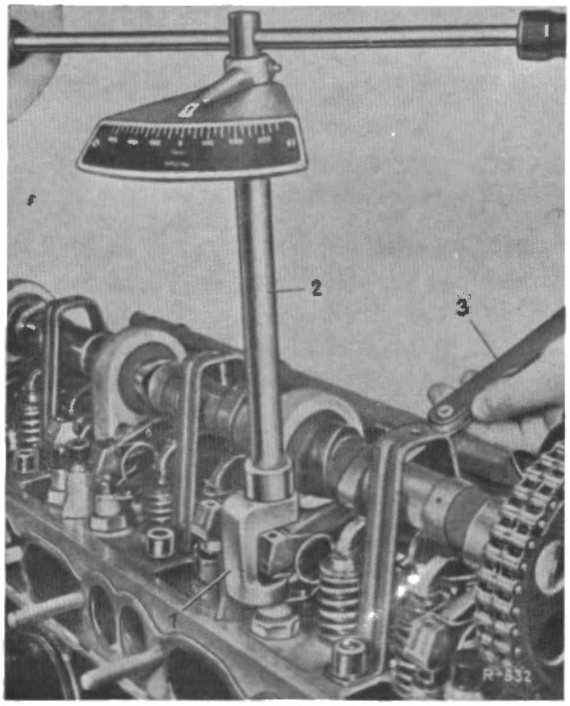


Fig. 00-3/3
Adjustment of tappet clearance

1 Adapter for tappet clearance adjustment 111 589 00 01
2 Torque wrench
3 Valve gage holder with tolerance feeler band 0.08 mm and 0.15 mm

adjust the tappet clearance by turning the ball pin head (3) at the hexagon collar (SW 14) by means of Adapter 111 589 00 01 (1) and a torque wrench (0-6 mkg) (2) (Figs. 00-3/1 and 3). If the tappet clearance is too small, increase it by screwing in the ball pin head. If the tappet clearance is too large, decrease it by screwing out the ball pin head. When the ball pin head (3) is turned in the base (1) the adjusting torque must be at least 1.5 mkg (Fig. 00-3/1).

If the adjusting torque is less, either the ball pin head (3) or the ball pin base (1) or both parts must be replaced. If the tappet clearance is too small and the ball pin head with hexagon SW 14 cannot be screwed further into the ball pin base, a thinner pressure piece (7) can be installed in the valve spring retainer (9) (Fig. 00-3/1). The standard thickness of the pressure pieces is 4.5 mm but they are also available 3.5 mm and 2.5 mm thick. To replace the pressure piece the rocker arm must be removed (see Job No. 05-1).

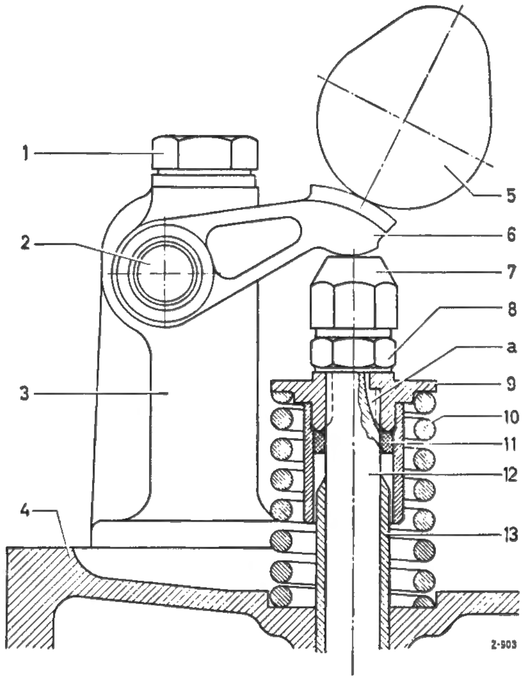


Fig. 00-3/4
Valve arrangement on Model 190 Dc

a Groove in valve shaft
1 Extending screw
2 Rocker arm shaft
3 Rocker arm block
4 Cylinder head
5 Camshaft
6 Rocker arm
7 Cap nut
8 Hexagon nut
9 Valve spring retainer and sealing ring retainer
10 Valve spring
11 Rubber sealing ring
12 Valve shaft
13 Valve guide

b) on **Model 190 Dc**

Slacken the hexagon nut (8) on the valve by means of the special wrench (14) holding the cap nut (7) steady with the special wrench (16). Then adjust the prescribed tappet clearance by turning the cap nut (7) using the special wrench (16) (see Job No. 00-0). If the valve turns when the cap nut is being turned, hold the valve steady at the hexagon of the valve spring retainer (9) by means of the special wrench (17). After adjusting the cap nut (7) lock it by tightening the hexagon nut (8) and once again check the tappet clearance (see Figs. 00-3/4 and 5).

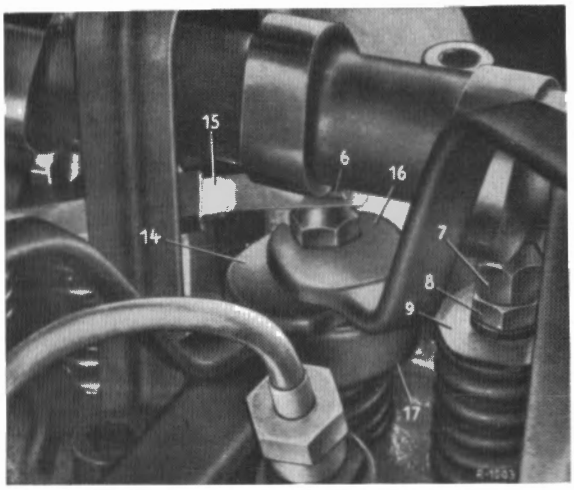


Fig. 00-3/5

Tappet clearance adjustment on Model 190 Dc

6 Rocker arm
7 Cap nut
8 Hexagon nut
9 Valve spring retainer and sealing ring retainer
14 Special Wrench Part No. 621 589 01 01 for slackening and tightening the hexagon nut (8)
15 Tolerance feeler band
16 Special Wrench Part No. 621 589 00 01 for adjusting and steadying the cap nut (7)
17 Special Wrench Part No. 621 589 00 03 for steadying the valve at the valve spring retainer (9)

c) on **Model 300 SE**

Unscrew the hexagon nut on the rocker arm and adjust the prescribed tappet clearance by turning the adjusting screw (1 or 20) (Fig. 00-3/6).

6. Put on the cylinder head cover and tighten by means of the tensioning screws.

When putting on the cylinder head cover make sure that the gasket is properly seated.

7. Screw in the spark plugs, connect the ignition lead plugs and the high-tension cables. Connect the air vent line to the cylinder head cover.

Note: In Models 300 SE and 220 SEb with the 2nd version control linkage install the control shaft (see Job No. 00-16). In the case of gasoline engines attach the carburetor scoop.

8. Run the engine and check the cylinder head cover for leakage at the jointing surface.

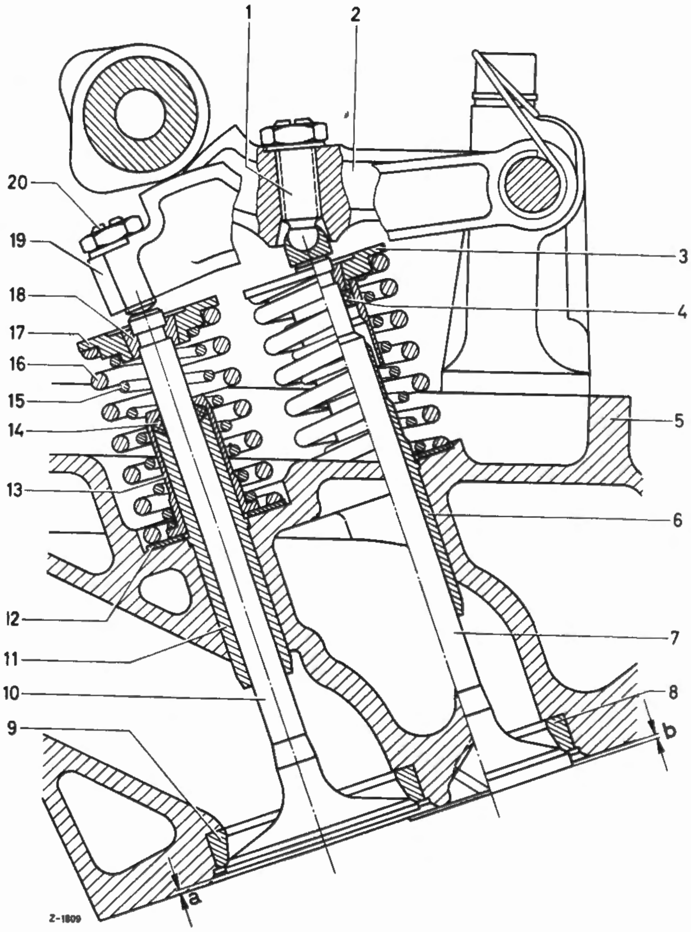


Fig. 00-3/6

Valve arrangement on Model 300 SE

1 Adjusting screw and ball cup for exhaust valve
2 Rocker arm (exhaust)
3 Valve spring retainer and sealing ring retainer for exhaust valve
4 Sealing ring (exhaust)
5 Cylinder head
6 Valve guide (exhaust)
7 Exhaust valve
8 Valve seat ring (exhaust)
9 Valve seat ring (inlet)
10 Inlet valve
11 Valve guide (inlet)
12 Washer
13 Sealing ring retainer (inlet)
14 Sealing ring (inlet)
15 Inner valve spring
16 Outer valve spring
17 Valve spring retainer (inlet)
18 Valve cone halves
19 Rocker arm (inlet)
20 Adjusting screw (inlet)

a = Distance between jointing surface cylinder head and inlet valve spring retainer
b = Distance between jointing surface cylinder head and exhaust valve spring retainer

Job No. 00-7

Ignition Setting

Before setting the ignition the contact gaps should be checked and if necessary corrected since any alteration in the contact gaps also changes the ignition setting.

a) Gasoline Engines:

The ignition setting is adjusted to the value prescribed for the basic setting by means of a timing light (for values see Job No. 00-0). The spark plugs must be removed, so that the engine can be easily turned and accurate adjustment is guaranteed. The check should be made at least twice.
If a flash stroboscope is available the ignition setting is adjusted at the starter speed; the value is the same as that of the basic setting. By means of the flash stroboscope the ignition setting can be checked over the whole speed range so that the distributor can be checked at the same time (for stroboscope values see Job No. 00-0).

b) Injection Engines:

In the case of injection engines the basic setting is only given as an assembly setting for installing the distributor.
The ignition setting must be adjusted by means of the flash stroboscope to a specified value for a certain definite engine speed (for adjusting value see Job No. 00-0).

Checking of Fuel Level and Injection Amount

Job No.
00-11

Modification: Zenith Carburetor added

A. Measuring and Adjusting of Fuel Level

Measurement and adjustment of fuel level are the same as for the previous carburetors with the exception of Model 220 Sb with Zenith carburetor. In the case of the Zenith carburetor the distance is measured from the separating surface of the plate block (with seal) to the top edge of the float.

Measuring and Adjustment Values

Model	Carburetor designation	Fuel level or float adjustment (mm)
190 c	Solex 34 PICB	17—19
220 b		
220 Sb	Solex 34 PAITA	19—21
	Zenith 35/40 INAT	18—20

B. Measuring and Adjusting of Injection Amount

Before measuring the injection amount of the accelerating pump, check the following points:

a) Ease of Movement of Connecting Rod and Pump Arm

Both the connecting rod or the reversing lever and the pump arm must be able to move freely.

b) Beginning of Injection

When the throttle valve begins to open, a strong jet of fuel must emerge immediately, or on Model 220 Sb with Zenith carburetor after a throttle valve opening of 5°, from the injection tube. Should this not be the case, check the whole pump system, in particular the injection tube, the pump diaphragm, the rubberised-fabric gasket ad the ball valves for leaks and proper assembly.

c) Direction of Fuel Jet on Injection

The jet of fuel must hit the opposite throttle valve opening without touching the mixing tube holder or the pre-atomiser (Fig. 00-11/1).

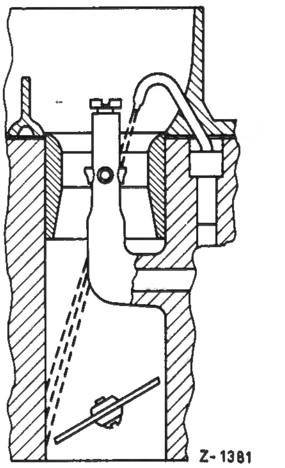


Fig. 00-11/1

Direction of fuel jet

If necessary the direction of the jet of fuel can be corrected by bending the injection tube.

It is advisable to measure the injection amount by means of Measuring Container 180 589 10 21, which has a capacity sufficient for one pump stroke. When this measuring container is used for Solex carburetors it is not necessary to remove the carburetor cover or to replace the injection tube by a measuring tube. On Model 220 Sb with Zenith carburetor unscrew the carburetor cover and the pre-atomiser.

Measuring and Adjustment Values

Model	Carburetor designation	Injection amount cc/stroke
190 c	Solex 34 PICB	1.0—1.2
220 b		0.9—1.2
220 Sb	Solex 34 PAITA	1.3—1.7 Correcting by adjustment of the connecting rod is not permissible!
	Zenith 35/40 INAT	0.8—1.2 (cannot be adjusted)

Models 190 c, 220 b

For Carburetor 34 PICB the injection amount is adjusted not by means of the adjusting nut but by inserting or removing washers between the pump arm and the cotter pin on the connecting rod of the accelerating pump.

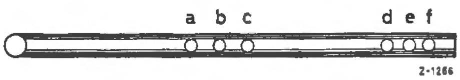


Fig. 00-11/2

Connecting rod

For the basic setting of the injection amount the cotter pins must be in bores 'a' and 'f'. On recent cars the holes a, b, and c have been replaced by raised limit stops for the spring (Fig. 00-11/2).

The injection amount is increased by inserting washers between the pump arm and the cotter pin and is decreased by removing washers.

If the injection amount is below the prescribed figure, the pump diaphragm must be replaced. When a new pump diaphragm has been installed or when shims have been added or removed, the injection amount should be checked as a matter of routine.

Model 220 Sb

In the case of Solex Carburetor 34 PAITA on Model 220 Sb, any adjustment of the connecting rod of the accelerating pump changes not only the injection amount but also the delivery point of full-load enrichment. The connecting rod should only be adjusted in accordance with the prescribed data for the delivery point of full-load enrichment; if this is adjusted correctly, the necessary injection amount of the accelerating pump is obtained automatically, provided always that the whole pump system is working properly.

C. Checking and Adjusting the Delivery Point for Full-Load Enrichment

Measuring and Adjustment values

Model	Carburetor designation	Remarks (see also Job No. 07—0)	Beginning of full-load enrichment at a throttle valve opening of
220 Sb	Solex 34 PAITA	1st Version (Carburetor with accelerating-pump diaphragm disk of 22 mm diameter	65°—70°
		2nd Version (Carburetor with accelerating-pump diaphragm disk of 32 mm diameter)	1°—4° after throttle valve of Stage II has begun to open

a) 1st Version

1. Detach the spring-loaded push rod (8) from the throttle valve lever (9) (Fig. 00-13/2). Back out the idle adjustment screw (11) until the throttle valve of Stage 1 is completely closed.

2. Unscrew the hexagon nut on the throttle valve lever and fit a suitable graduated disk on the throttle valve shaft by means of the threaded bolt. Attach the metal pointer to the starter mechanism by means of the cylindrical screw.

3. Adjust the graduated disk in such a way that **when the throttle valve is completely closed** the pointer points to 0° on the graduated disk.

4. Fit a hose (inside diameter appr. 8 mm) to the mixing tube holder of Stage 1.

5. In place of the main jet plug of Stage 1 screw in a main jet plug with soldered up front and side openings.

6. Screw out the pump jet and screw in instead a suitable pipe union and attach a suitable hose about 1/2 meter long to the pipe union.

Note: The two hoses must be of fuel-resistant material.

7. In order to check the beginning of the full load enrichment put the hose attached to the mixing tube holder in a container filled with water and blow into the hose attached to the pipe union, at the same time slowly opening the throttle valve until numerous air bubbles suddenly rise from the hose in the container filled with water. This is the delivery point for full load enrichment. It should occur at a throttle valve opening of 65°–70°.

Note: Repeat the process several times in order to obtain accurate values. Just before the delivery point is reached the throttle valve lever should be moved very slowly. If full load enrichment occurs too early or too late the delivery point should be adjusted by screwing in (later delivery point) or screwing out (earlier delivery point) the adjusting nuts on the connecting rod of the accelerating pump.

b) 2nd Version

1 Fit a hose over the mixing tube holder of stage 1, as described above in Section a). In place of the main jet plug of stage 1, screw in a main jet plug closed in front and at the side.
In place of the pump jet, screw in a pipe union of the same size and connect a hose.

2. Now check the delivery point, as described in Section a) para 7; it should be 1–4° after the initial opening of the stage 2 throttle valve. The delivery point is adjusted as described in the note to para 7.

Note: After some experience, the graduated disk can be dispensed with. The most important point is to make sure that full-load enrichment does not occur too early.

Adjustment of Gasoline Engine

Job No.
00-13

Modification: Progressive accelerator linkage and Zenith carburetor added

Model 190 c

a) Adjustment of Accelerator Linkage

1. Check the throttle valve shaft for freedom of movement. To do this detach the push rod (9) from the throttle valve lever (11) and detach the return spring (10) (Fig. 00-13/1).

2. Turn out the idle adjustment screw (8) on the throttle valve lever until the throttle valve is completely closed. Then turn in the idle adjustment screw until the throttle valve lever is just about to open. From this position turn in the screw one turn.

3. Press the throttle valve lever to full load position and check whether the aperture limiting screw (12) rests against the full load stop of the carburetor housing.

4. Attach the push rod (9) and the return spring (10) to the throttle valve lever. Again check the throttle valve position moving the accelerator linkage by depressing the accelerator pedal from inside the car.

b) Adjustment of Idle

1. To adjust the idle, screw the idle mixture adjustment screw (7) right in, then back it out exactly two turns.

2. After warming up the engine (cooling water temperature at least 70° C) adjust the idle to 750-800 rpm by means of the idle adjustment screw (8), using a revolution counter.

3. Adjust the idle mixture adjustment screw by turning it slowly in and out so that
   a) the engine turns smoothly and
   b) the highest possible idle speed is reached.

4. Then adjust the idle speed to 750-800 rmp by means of the idle adjustment screw (8).

5. By making a further slight correction with the idle mixture adjustment screw try to improve the idle. If necessary, adjust the idle speed once more with the idle adjustment screw.

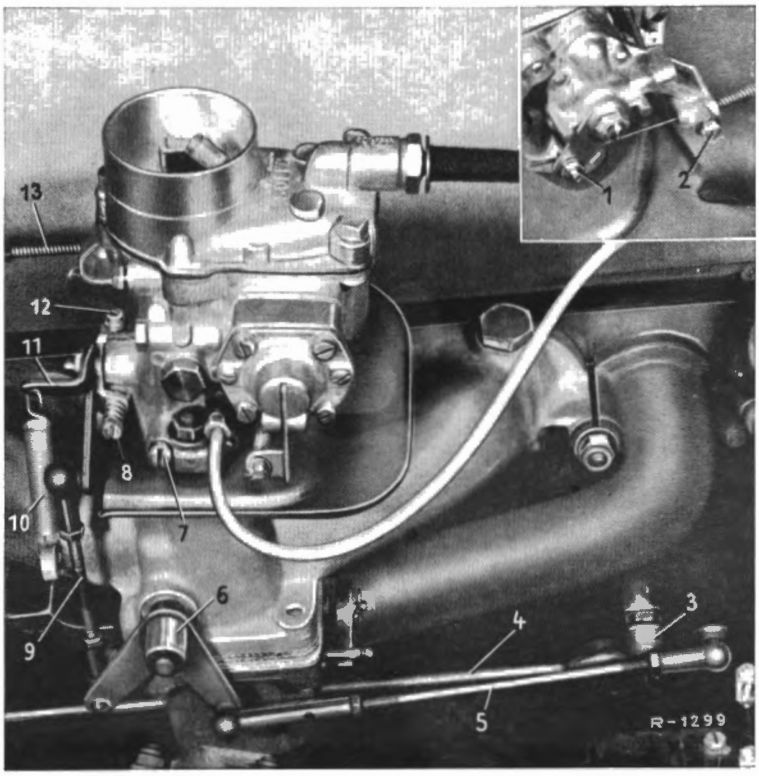


Fig. 00-13/1

Carburetor Model 190 c

1 Clamping screw
2 Clamping screw
3 Control lever
4 Rod
5 Rod
6 Control lever
7 Idle mixture adjustment screw
8 Idle adjustment screw
9 Push rod
10 Return spring
11 Throttle valve lever
12 Aperture limiting screw
13 Choke control

B. Models 220 b, 220 Sb

a) Adjustment of Accelerator Linkage

Model 220 b with Solex Carburetor 34 PICB, Model 220 Sb with Solex Carburetor 34 PAITA

The design and adjustment of the accelerator linkage is the same in Models 220 b and 220 Sb. On recent cars of both Models a progressive linkage has been installed in order to improve fuel metering for starting off and low speed (see Fig. 00-13/4).

1. Detach the push rods (2) and (6), or (3) and (5) in Fig. 00-13/4, check their length and adjust them. The length of push rod (2) should be 85 mm, in the case of push rod (5) 98 mm, from center ball socket to center ball socket. The length of push rod (6), or (3), should be 188 mm. After adjustment apply grease to the ball sockets of the push rods and press the ball sockets home again. Now detach the spring-loaded push rod (8), or (1), from the front and rear carburetors. Check the carburetor linkage and the throttle valve shafts for freedom of movement and if necessary detach the return springs (10) (Figs. 00-13/2, 00-13/3, and 00-13/4).

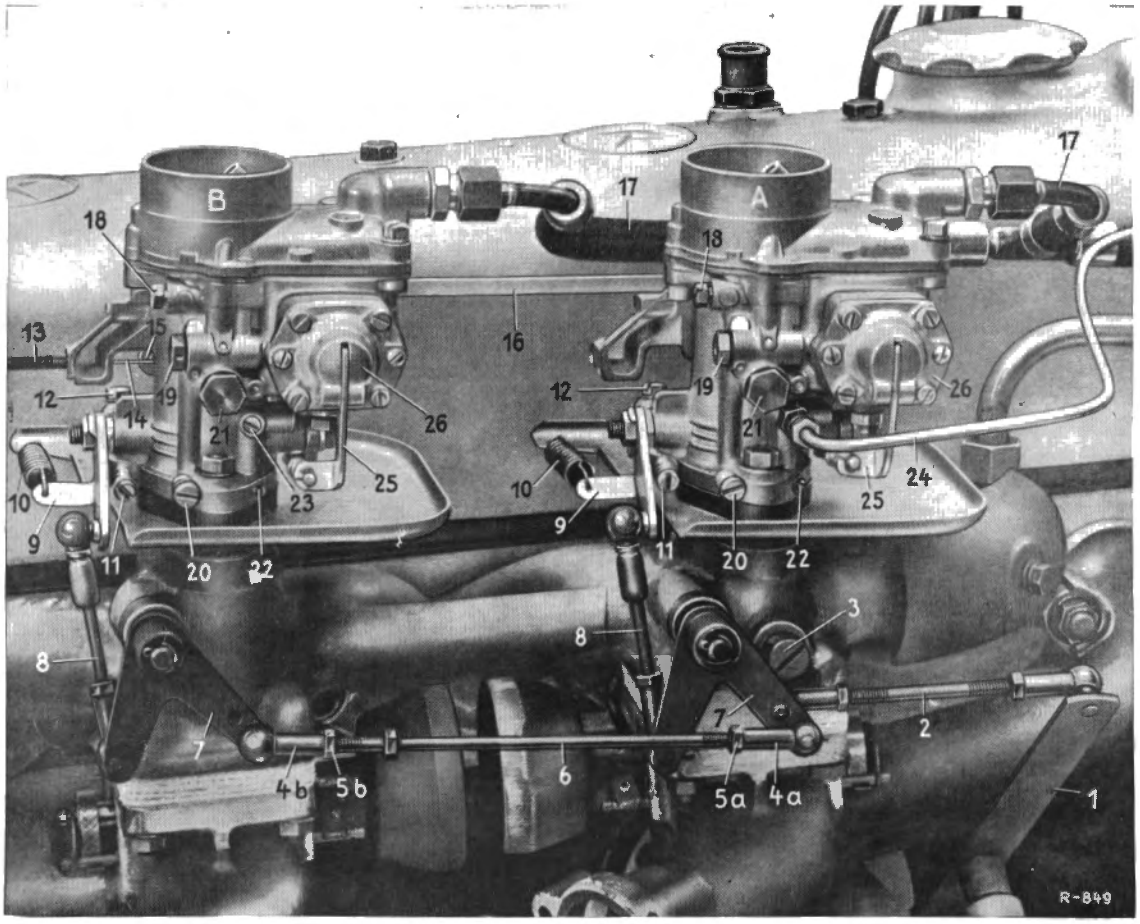


Fig. 00-13/2

Model 220 b with Solex Carburetor 34 PICB

1 Double lever
2 Push rod
3 Eccentric screw
4a Ball socket, left-hand thread
4b Ball socket, right-hand thread
5a Hexagon nut, left-hand thread
5b Hexagon nut, right-hand thread
6 Push rod
7 Relay lever
8 Spring-loated push rod
9 Throttle valve lever
10 Return spring
11 Idle adjustment screw
12 Aperture limiting screw
13 Coil spring for choke control
14 Choke control
15 Clamping screw for choke control
16 Connecting road
17 Fuel line
18 Idle fuel jet
19 Pump jet
20 Idle mixture adjustment screw
21 Main jet
22 Union for testers
23 Screw plug
24 Vacuum line distributor
25 Pump arm
26 Accelerating pump

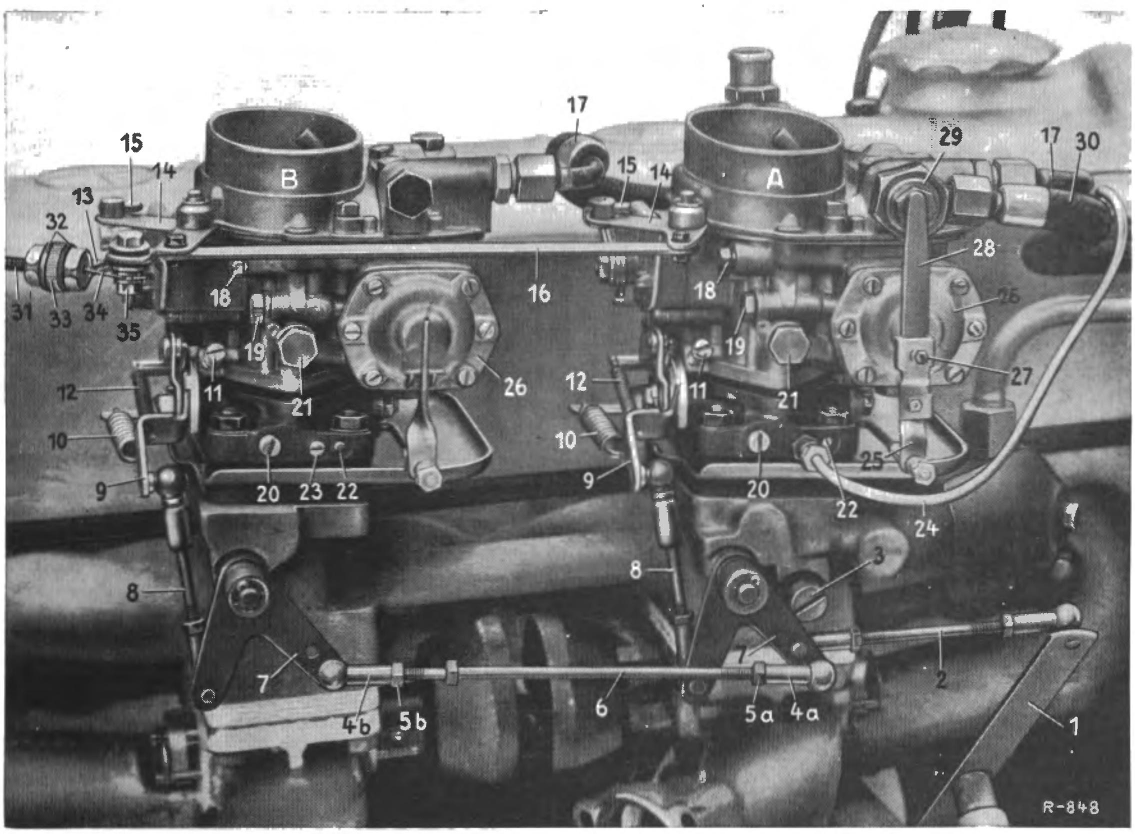


Fig. 00-13/3

Model 220 Sb with Solex Carburetor 34 PAITA

1 Double lever
2 Push rod
3 Eccentric screw
4a Ball socket, left-hand thread
4b Ball socket, right-hand thread
5a Hexagon nut, left-hand thread
5b Hexagon nut, right-hand thread
6 Push rod
7 Relay lever
8 Spring-loaded push rod
9 Throttle valve lever
10 Return spring
11 Idle adjustment screw
12 Return spring
13 Clamp
14 Relay lever
15 Connecting rod (to starter lever)
16 Connecting rod
17 Fuel pressure line
18 Idle fuel jet
19 Pump jet.
20 Idle mixture adjustment screw
21 Main jet of stage 1
22 Union for testers
23 Screw plug
24 Vacuum line, distributor
25 Pump arm
26 Accelerating pump
27 Adjustment screw and lock nut
28 Spring-loaded pump arm head
29 Fuel return valve
30 Fuel return line
31 Coil spring for choke control
32 Rubber bushing
33 Adjusting nut
34 Choke control
35 Clamping screw for choke control

2. Press the throttle valve lever (9) as far as the full load stop. In the case of the carburetor for Model 220 b the aperture limiting screw (12) must rest against the full load stop of the carburetor housing and the throttle valve must be completely opened (Fig. 00-13/2).
   In the case of the carburetor for Model 220 Sb the stop lever on the throttle valve shaft of Stage 2 must rest against the carburetor housing, and both the throttle valve of Stage 1 and the throttle valve of Stage 2 must be completely opened (Fig. 00-13/3).

3. Turn out the idle adjustment screw (11) on the throttle valve lever of the two carburetors until the throttle valve is completely closed. Then turn in the idle adjustment screw until the throttle valve is just about to open. Now turn in the adjustment screw **one turn** (Figs. 00-13/2 and 00-13/3).

4. Adjust the spring-loaded push rods (8) or (1).
   On engines without progressive linkage adjust the eccentric screw (3) in such a way that the slot of the eccentric screw is at right angles to the front relay lever and the eccentric part points upward (see Figs. 00-13/2 or 00-13/3).
   On engines with progressive linkage screw in a fillister head screw M 8 DIN 85 (4) with a 16 mm head. If this should not be available, make an M 8 screw with a 16 mm ⌀ cylindrical head (4) (see Fig. 00-13/4).

5. Apply the relay lever to the eccentric screw or the head of the fillister head screw and check to make sure that the throttle valve lever rests against the idle adjustment screw. Then adjust the two spring-loaded push rods in such a way that the ball sockets of the push rods can be fitted to the ball pins of the throttle valve levers and the relay levers without forcing. Apply grease to the ball sockets and press them home. Unscrew the fillister head screw.

Note: The spring-loaded push rods should be neither too long nor too short. If a push rod is too long the throttle valve is opened, and if the push rod is too short the spring of the spring-loaded push rod is stretched.
In the case of the progressive linkage the quadrant lever (9) serves as a stop so that a stop bolt on the intake pipe is no longer required (Fig. 00-13/4).

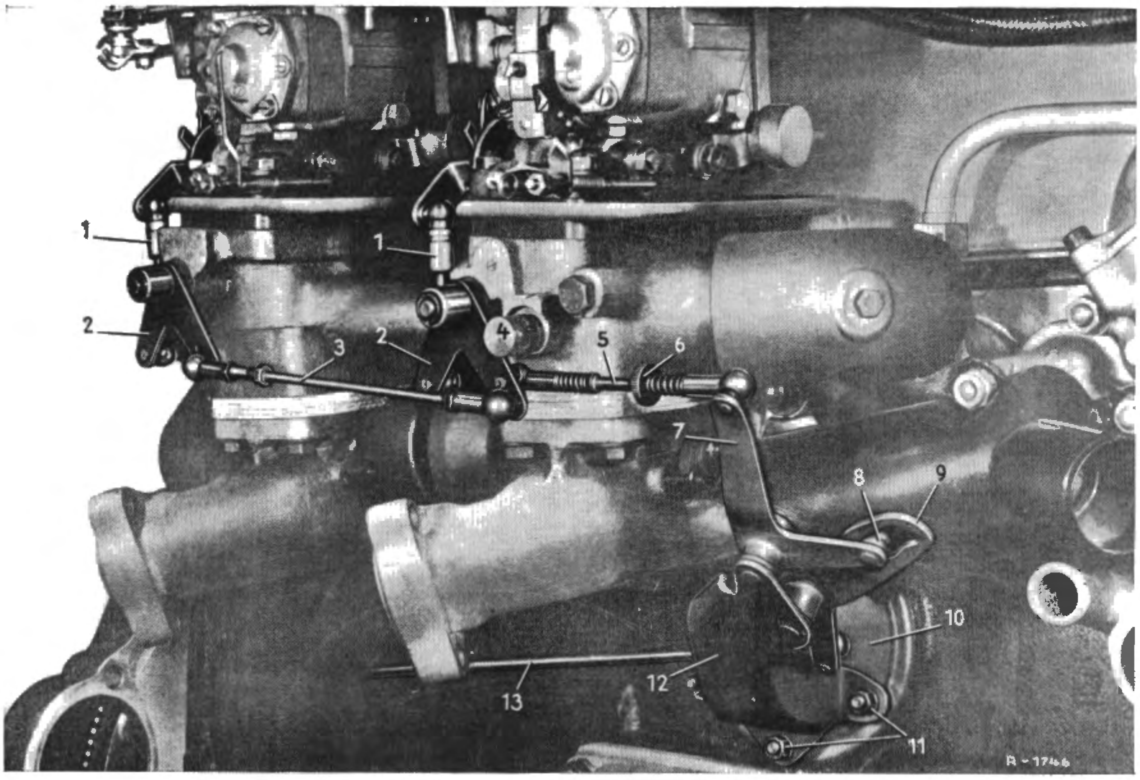


Fig. 00-13/4

Model 220 Sb with Solex Carburetor 34 PAITA and progressive linkage

1 Spring-loaded push rod
2 Relay lever
3 Push rod
4 Adjustment screw or fillister head screw M 8 DIN 85
5 Push rod
6 Adjusting ring
7 Relay lever
8 Roller
9 Quadrant lever
10 Cylinder cover
11 Threaded bolt
12 Bearing bracket

6. Check again the throttle valve position by depressing the accelerator pedal from inside the car (see figure 2).

Model 220 Sb with Zenith Carburetor 35/40 INAT

1. Detach the push rods (9) and (13). Check the control levers and the throttle valve shafts for freedom of movement.
   Check the full-load stop using the reversing lever (7) to push the throttle valve lever (2) until it rests against the carburetor housing (Fig. 00-13/5).

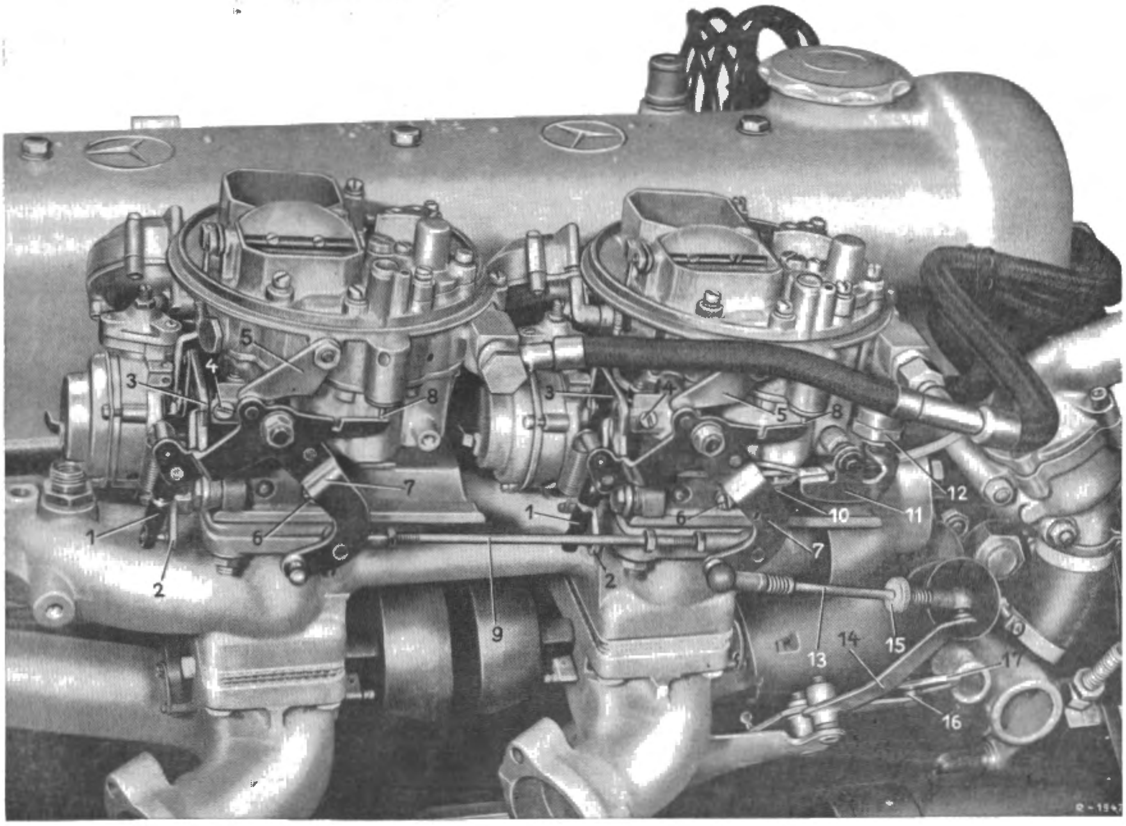


Fig. 00-13/5

Model 220 Sb with Zenith Carburetor 35/40 INAT

1 Connecting rod	7 Reversing lever	13 Push rod
2 Throttle valve lever	8 Float chamber vent valve	14 Relay lever
3 Quadrant lever	9 Push rod	15 Adjusting ring
4 Idle adjustment screw	10 Adjustment screw	16 Roller
5 Pump arm	11 Lever	17 Quadrant lever
6 Idle mixture adjustment screw	12 Fuel return valve	

2. Adjust the idle adjustment screw (4) of the two carburetors. When the engine is cold first cut out the automatic start mechanism by opening the choke valve by hand and at the same time accelerating for a short timme by means of the reversing lever. Unscrew the idle adjustment screw (4) on the throttle valve lever (2) until the throttle valve is completely closed. Then turn in the idle adjustment screw until the throttle valve is just about to open (Fig. 00-13/5). Now turn in the adjustment screw (4) **one turn.**

3. Adjust the plastic connecting rods (1) to 40 mm and attach (Fig. 00-13/5).

4. Adjust the push rod (9) in such a way that it fits the ball pins of the reversing levers without forcing. While doing this the throttle valve levers of both carburetors should rest against the idle stop screw.

5. Again check whether the control linkage is working properly by depressing the accelerator pedal from inside the car.

b) Adjustment of Idle

The idle adjustment and the adjustment of the idle speed is the same for the engines of Models 220 b and 220 Sb.

1. Screw the idle mixture adjustment screw (20) or (6) right in and back it out again 1½ turns on the carburetor for Model 220 b and two turns on the carburetor for Model 220 Sb (Figs. 00-13/2, 00-13/3 and 00-13/5).

2. Warm up the engine to normal working temperature (cooling water temperature appr. 80° C).

3. On engines with progressive control detach the push rods (5) or (13) (Figs. 00-13/4 and 00-13/5).
On engines without progressive control turn the eccentric screw (3) until there is sufficient distance between the eccentric screw and the relay lever (7) for the adjustment of the idle (Figs. 00-13/2 and 00-13/3).

4. Adjust the idle to n = 750—800 rpm by evenly adjusting the idle adjustment screw (11) or (4) on the two carburetors, using a revolution counter (Figs. 00-13/2, 00-13/3 and 00-13/5).

5. Adjust the two idle mixture adjustment screws by turning them **evenly** in and out so that
a) the engine turns smoothly and
b) the highest possible idle speed is reached.

6. Now adjust the idle speed once more to n = 750—800 rpm by means of the idle adjustment screws.

7. By making a further slight correction with the idle mixture adjustment screws try to improve the idle. If necessary, adjust the idle speed once more with the idle adjustment screws.

8. On Model 220 Sb with a Zenith carburetor check the float chamber vent. When the throttle valve is in idle position the reversing lever (7) should lift the pin of the valve (8) by **1.5—2** mm. If this is not the case bend the reversing lever (7) by means of a pair of pliers, making sure that after bending the reversing lever points in an accurately vertical direction to the valve pin (Fig. 00-13/5).

9. On engines with progressive control attach the push rod (5) or (13). Then use the adjusting ring (6) or (15) to adjust the relay lever (7) or (14) in such a way that the roller (8) or (16) in the quadrant lever (9) or (17) **rests against the limit stop without any tension** (Figs. 00-13/4 or 5). If the adjustment is correct the engine should run in idle position at the prescribed idle speed and should react immediately to any movement of the quadrant lever.
On engines without progressive control turn the eccentric screw (3) in such a way that there is a play of approx. 0.2 mm between the eccentric screw and the relay lever (7) (Figs. 00-13/2 and 3).

10. In the case of a Solex carburetor check whether the two starter mechanisms which are connected by the connecting rod (16) work properly (Figs. 00-13/2 and 3).

11. In Model 220 Sb check whether the vacuum valves of Stage 2 and the shock-absorbers are working properly. The cushioning effect of the shock-absorbers must be noticeable almost down to the end of the stroke. If necessary, check the oil level of the shock-absorbers and top up.

Note: The "Synchro-Test" appliance produced by the firm Moto-Meter can be used to check the correct adjustment of the accelerator linkage.

Checking of Fuel Injection System

Job No.
00-15

A. Injection Pump

Accurate checking and adjusting of the injection pump is only possible on an injection pump test bench specially equipped for this pump. It should be noted that arbitrary adjustment of the pump may cause defects in the engine. Damaged or faulty injection pumps should be sent for repair to the firm of Robert Bosch or a Bosch agency or to a Daimler-Benz branch.

Injection pumps are supplied and tested together with the fuel distributor fittings and the injection valves. For this reason the injection pump may only be replaced **complete with Distributor Fittings and Injection Valves.**

a) Checking Ease of Movement of Control Assembly and Fuel Control Rod

In order to check the control assembly for ease of movement detach the two push rods at the adjustment lever. The adjustment lever should then be pushed as far as the full load stop. Let the lever move backward slowly until it rests against the idle stop, exerting a slight counter pressure on the lever. During this operation the adjustment lever must not catch.

On the R 1 Injection Pumps there is positive connection between the fuel control rod and the control assembly (on the R 2, R 3, and R 4 pumps the connection is non-positive). In the case of these pumps it is therefore not sufficient to check the control assembly for ease of movement but the fuel control rod, too, must be checked for ease of movement. To do this, detach the two push rods at the adjustment lever, unscrew the protective cap for the fuel control rod at the front of the injection pump, screw an M 5 screw into the fuel control rod and use this screw to move the fuel control rod backward and forward. There should be no noticeable resistance.

In the case of the R 1 Injection Pump the ease of movement of the fuel control rod can also be checked with the engine running. Accelerate the engine by operating the adjustment lever on the injection pump and move the adjustment lever back to the idle stop; in the idle position the same idle speed must always be obtained.

At the same time the fuel control rod can be observed which should always return to the same initial position. In order to be able to follow the movements of the fuel control rod closely, screw an M 5 screw into the front end of the rod.

Ease of movement of the fuel control rod can also be checked with the help of the idle air throttle in the venturi control unit. If after operating the adjustment lever (acceleration and deceleration) the idle speed can be considerably increased by backing out the idle air throttle, the fuel control rod does not move freely.

Injection pumps in which either the fuel control rod or the control assembly catches, must be replaced.

b) Checking Operation of Inlet Air and Cooling Water Thermostat

If a thermostat is defective, the working pin (2) does not project sufficiently (and can be easily pressed in) so that the engine receives too much fuel when warm (Fig. 00-15/1). The result is high

fuel consumption, uneven idle and a bad warm start. If the mixture enrichment is too great because of a defective cooling water thermostat, the warm engine will no longer start even with the accelerator pedal fully depressed. Enrichment caused by a defective inlet air thermostat has no unfavorable influence on the starting response of a warm engine. The thermostats are checked for faults as follows:

As is described in Job No. 07-10, Section C, the pump has a stop bolt for the cooling water thermostat and a stop screw for the inlet air thermostat (see nos. 59 and 62 in Fig. 07-10/10).

As soon as the stop bolt or the stop screw is moved in the way described there, with the engine running at normal working temperature, a defective thermostat will change the idle.

Another check can be made on the thermostat itself. Measure the dimension "a" with a load of 3 kg on the working pin (2) and at a temperature of 20° C; "a" should be 6 ± 0.08 mm (Fig. 00-15/1).

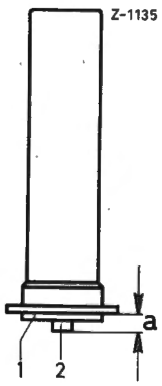


Fig. 00-15/1

a = 6 ± 0.08 mm
1 Housing
2 Working pin

For every increase in temperature of 10° C the working pin travels 0.5 mm so that at 80° C it projects 9 mm.

Note: In some pumps thermostats have been installed which travel only 0.2 mm. Such thermostats are marked "GLF" on the upper face.

The stop bolt and the stop screw are not lead-sealed but locked against unauthorized adjustment by a wire. The lock wire can be removed but should be fixed again after the check has been made.

c) Checking of Cold Start Magnet

When the starter is being operated at a cooling water temperature below 45 ± 3° C the cold start magnet automatically causes the fuel control rod to be moved to starting delivery.

The operation of the cold start magnet can be checked by observing the movement of the fuel control rod during starting. To do this, unscrew the protective cap for the fuel control rod at the front of the injection pump.

When the engine is not running, the fuel control rod is in the rear position, during starting it is in the front position.

If the fuel control rod does not move to full load, the cold start magnet is defective, provided that the current supply and the thermo switch in the cooling water outlet connection are not at fault.

When a cold start magnet is replaced, measure the dimension "a" and adjust the new magnet to this dimension (Fig. 00-15/2). The dimension "a" can only be measured and adjusted if the bar is moved as far as it will go, either electrically or by hand. To adjust the bracket, loosen the lock nut (2) and move the bracket (3) until the dimension "a" is obtained.
When installing the magnet make sure that the open side of the bracket points to the control assembly cover. In order to check the correct adjustment of the cold start magnet, measure the clearance of the fuel control rod in starting position when the circuit is closed. It must be 0.5 + 0.2 mm.

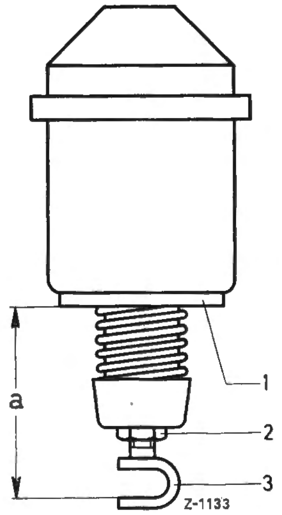


Fig. 00-15/2

1 Cold start magnet
2 Lock nut
3 Bracket

The cold start magnet can be replaced without unscrewing the control assembly cover.

d) Testing of Check Valve for Leak-off Oil Lock

The check valve on the injection pump can be disassembled for cleaning.

The opening pressure is 0.5 atm.

When screwing the valve to the injection pump take care to tighten the hollow screw well since otherwise oil may be lost.

e) Cleaning of Injection Pipes
The injection pipes must be completely free from dirt particles and impurities.
When new pipes are to be installed and there is no guarantee that they are absolutely clean, they must be flushed out beforehand. An old diesel injection pump and diesel injection nozzles can be used for this purpose. The pipes must be flushed out for some time and at a pressure of about 100 atm. with as large a quantity as possible of clean, filtered diesel oil.
Blowing out with compressed air or flushing without pressure is not sufficient.

Injection Pipes from Injection Pump to Fuel Distributor Fittings
These Pipes should be replaced after a Mileage of 70 000 km
When the pipes are being replaced, the injection valves, the fuel distributor fittings, and the injection pipes should be cleaned as follows:
Knock the dry injection valves with the connectors against a piece of wood in order to remove any dirt particles that may have accumulated in the filter. Afterwards give the connector a thorough wash in gasoline.
Flush out the fuel distributor fittings with **Gasoline** contrary to the direction of flow, using a hand-operated nozzle tester.
Clean the injection pipes as described above.

Before the new pipes between the injection pump and the fuel distributor fittings are installed, it is necessary to check their free cross-section. The internal diameter of the two pipes for the front and the rear distributor fitting should be 3.5 mm and must be the same for the two pipes. Any difference in the internal diameter of the two pipes will result in uneven fuel distribution to the front and rear cylinder groups and consequently in an unsatisfactory idle. For this reason, pipes with too small a diameter must be bored to the prescribed diameter. **After this operation, the pipes must under all circumstances be properly cleaned.**

B. Fuel Distributor Fittings and Injection Valves

Fuel distributor fittings and injection valves are selected in the factory in such a way that the injection amount is the same for the three injection valves supplied by one distributor fitting. These associated parts are marked with letters and are only supplied as a complete set (Fig. 00-15/3).

In addition the front set of an assembly (fuel distributor fitting and injection valves for cylinders 1 to 3) is marked with a red dot.

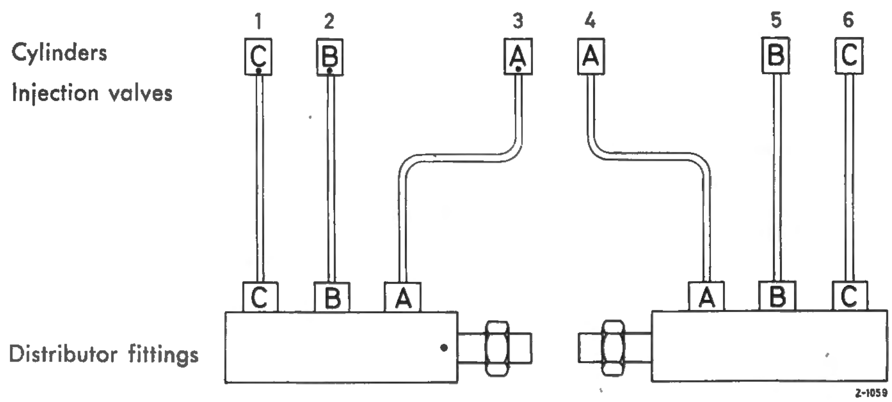


Fig. 00-15/3

Attention should be given to these marks during installation to prevent uneven fuel distribution to the individual cylinders and resulting bad running conditions of the engine.

For the same reason, the fuel distributor fitting and the injection valves must never be replaced individually but **only as a set.**

To facilitate stock keeping, replacement distributor fittings and replacement valves are supplied without the red dot which should however be subsequently applied to the distributor fitting and the three injection valves when the front set (for cylinders 1 to 3) is replaced.

Note: On the first engines for Model 220 SE the distributor fittings and the valves were marked with the number of the cylinder.

a) Checking of Injection Valves

The injection valves can be checked for correct injection pressure by means of a standard commercial tester and test oil.

Before checking the valves make sure that **both tester and test oil are absolutely clean. The same applies to the filter of the tester** which must be cleaned if necessary. Furthermore, the tester should be operated several times without the valve to ensure that any dirt particles that may be lodged in the device are flushed out. During the actual check the pump lever of the tester should be moved up and down smartly so that the nozzle can spray properly.

Modification: On page 00-15/6 Part Numbers added for the distributor group on Model 300 SE and on page 00-15/7, 3rd line, tightening torque modified and in the last line but two delivery amount modified.

1. Sight Check of Injection Valve Jet

The shape of the jet can be checked by depressing the pump lever quickly (2-3 strokes per second) while the pressure gage is not operative. The jet must be evenly and well atomized and must be completely cone-shaped.

If the jet drips, if it is too broad or not completely cone-shaped, the injection valve is not working properly.

If one injection valve does not meet the above requirements, the complete distributor group should be exchanged or replaced.

2. Spray or Opening Pressure of Injection Valves

With the pressure gage in operation slowly depress the hand pump lever (1 stroke per sec.) and read off the spray pressure on the pressure gage when the valve begins to open or to spray.

Caution! When the pressure gage is in operation, increase the pressure very slowly and above all decrease it very slowly since otherwise the pressure gage may be damaged.

The spray or opening pressure of the injection valves should be 13.0 to 15.5 atm. to ensure even fuel distribution to the individual cylinders. **The difference in spray pressure of the three injection valves (distributor group) of one fuel distributor fitting must not exceed 0.5 atm.**

If the difference exceeds 0.5 atm. exchange or replace the complete distributor group with the defective valve.

3. Leak Check of Injection Valves

With the pressure gage in operation slowly depress the hand pump lever until the pointer on the pressure gage shows 3 atm. below the spray pressure measured before. The injection valve is leak-proof if no drop falls from the mouth of the injection valve.

If any one injection valve leaks the complete distributor group must be exchanged or replaced together with the defective valve.

b) Distributor Group

The even distribution of the amount of fuel delivered can be measured on a Bosch pump test stand or as follows:

The distributor group to be tested (fuel distributor fitting and three injection valves) is connected to a two-cylinder pump of the type used in the car. For this purpose properly working injection valves should be used whose spray pressure does not differ by more than 0.5 atm. Place a measuring glass under each injection valve.

The difference (maximum scatter) in the amount of fuel delivered by the injection valves should not exceed 2.5 cc/1000 strokes when idling (350 rpm of the injection pump) or 3.0 cc/1000 strokes at full load (1000 rpm of the injection pump).

The prescribed cold start amount per injection valve should be:

Model	Cold start amount/injection valve in cc/100 strokes		
	average	minimum	
220 SE 220 SEb	11-13	8	at 40 rpm of the injection pump and with Bosch test oil OL 61 v 1
300 SE	14-16	11	

If the differences at idle or full load exceed these values or if the fuel amount specified for a cold start is not obtained, exchange or replace the complete distributor group.

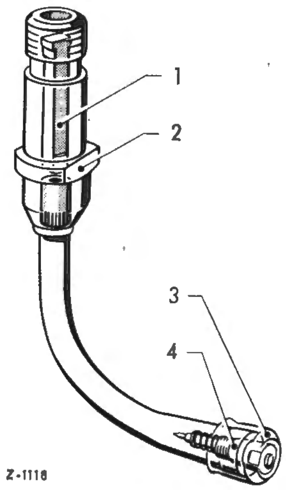


Fig. 00-15/4

Injection valve

1 Filter
2 Pipe union
3 Metal cap
4 Valve element

It has recently become possible to exchange a complete distributor group for Model 220 SEb Part No. 000 078 01 95/80 (Bosch Designation EPVT 1 P 12 Z injection valves with strainer) or Part No. 000 078 00 95/80 (Bosch Designation EPVT 1 P 11 Z injection valves with bar filter) and for Model 300 SE Part No. 000 078 02 95-80 (Bosch Designation EPVT 1 P 13 Z) (Fig. 00-15/3), that is a complete distributor group can by exchanged against a repaired distributor group in which the three injection valves (Fig: 00-15/4) have been fitted with new valve elements (4), the injection valve tubes with pipe union (2) and the associated fuel distributor fitting have been cleaned and the repaired distributor group has been checked for even fuel distribution.

If distributor groups are not available for exchange, any Bosch agency can replace the valve elements (4) of the damaged injection valves (Fig. 00-15/4), while retaining the injection valve tubes and pipe unions which had been removed, and reinstall them together with the associated fuel distributor fitting.

Before installing a distributor group or injection valves with new valve elements carefully flush the injection valves with a tester (for measuring the spray pressure) in order to ensure that the needle of the injection valve does not stick because of resin deposits after long storage.

Before installing the injection valve holder check the surface of the holder (10) and the surface on the intake pipe for damage. The surfaces must be absolutely even; leaks may occur if they are not. The gasket between the holder (10) and the intake pipe must always be replaced and must be fitted with Teroson sealing compound. When installing the flange (9) which holds the injection

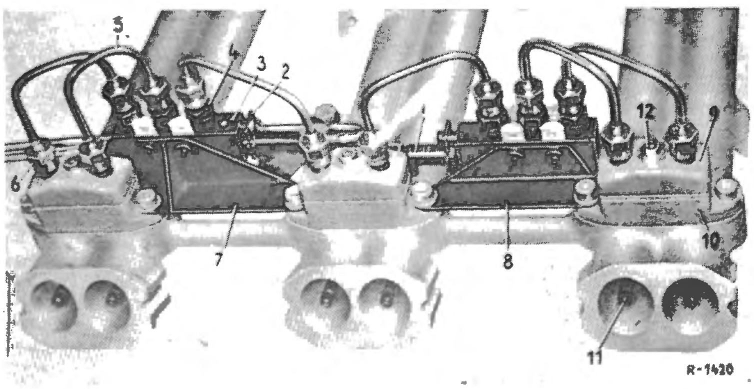


Fig. 00-15/5

1 Pressure pipe connection
2 Locking plate
3 Fuel distributor fitting
4 Pressure pipe connection
5 Injection pipe
6 Cap nut
7 Support for front distributor fitting
8 Support for rear distributor fitting
9 Flange
10 Injection valve holder
11 Injection valves

valves in the holder (10), the hexagon nut for fastening the flange (9) and the holder (10) must not be tightened beyond 0.8+0.2 mkg (Fig. 00-15/5).

The cap nuts (6) should be tightened to approx. 2.5 mkg.

It is advisable after installation to make a leak check of the holders (10) of the injection valves by a gasoline spraying test with the engine running.

Note: When checking or repairing any components of the injection system it is advisable always to consult the nearest Bosch agency.

C. Fuel System

a) Fuel Feed Pump

Before exchanging or replacing an electric fuel feed pump which seems to be defective always measure the delivery pressure and the delivery amount and check the pump chamber and the check valve for leaks.

Other repairs such as turning off the commutator, replacing carbon brushes and the slide ring seal should only be carried out by a Bosch agency because of the particular features of the fuel feed pump.

Only fuel feed pumps with improved ball bearing cover on the pump side should be installed. These pumps have the End Designation /1/B or A 1; the exchange pumps have the End Designation /1/B or A 1 or only /1 and in addition a blue dot below the direction arrow on the pump cover.

The two Models /1 and /1/B differ mainly in their field and armature coils and the carbon brush. Feed pump /1 has carbon brush WSK 16 Z 11 Z, and feed pump /1/B or A 1 has carbon brush WSK 16 Z 8 Z.

Checking Delivery Pressure

The delivery pressure, which is measured between fuel filter and damper unit, should be **not lower than 0.4 atm.** with a minimum terminal voltage at the feed pump of **10 volts** and an input at the feed pump of **3.1-3.5 amp.** If the pressure is loweer than 0.4 atm., either the filter is clogged or the output of the pump is insufficient. In either case the first thing to do is to check the permeability of the filter.

The easiest method is to replace the filter element by a new element and to measure the delivery pressure again. If the pressure is now considerably higher than before, the filter element was clogged. If after the replacement of the filter element the delivery pressure is not or only slightly higher than before, either the fuel feed pipe (narrow passage), the fuel strainer in the fuel tank (clogged) or the pump itself may be responsible.

If it is found that the pump itself is obviously responsible for the low delivery pressure or low output, the fuel feed pump must be replaced or exchanged.

Note: The delivery pressure and the delivery amount should be measured with the engine **not running.**

Measuring Delivery Amount

When measuring the delivery amount the fuel tank should be at least half full in order to ensure that the damper vessel in the fuel tank is always filled with fuel even when the return pipe has been detached.

The delivery amount should be measured **behind the return-line damper unit,** using a new filter element in the fuel filter. To do this, detach the return pipe and place a container under the pipe outlet. Then switch on the ignition for a period of 1 minute. During this period, the delivery amount should be **not less than 3.3** liters with a minimum terminal voltage at the feed pump of **10 volts** and an input at the feed pump of **3.1-3.5 Amp.**

Leak Check of Fuel Feed Pump

The pump chamber of the fuel feed pump is sealed against the electrical part (electric motor) by a slide ring seal. To check this seal watch the leak-off pipe (4) when the pump has run warm (see Fig. 07-10/15). The leak-off pipe must not be clogged. If drops form at comparatively short intervals the slide ring seal is damaged and the pump must at once be exchanged or replaced.

If dirt is suspected between the pump cover or housing and the impeller unscrew the pump cover (6) and carefully remove the impeller (with a provisional copper wire hook) (Fig. 00-15/7. Mark the position of the pump cover before removal since it must be reinstalled in exactly the same position as before. Care should also be taken to ensure that the Woodruff key for the impeller is not lost.

Clean the pump chamber; the pump cover must be free from dirt and ridges. If necessary it must be honed on a surface plate. Slight signs of wear on the cover are permissible but not grooves or scores.

The key must be fully serviceable otherwise it should be replaced. With the impeller installed the maximum play should be 18°.

The impeller must show no signs of damage, the vanes must have sharp edges and no score marks.

The contact surface of the impeller in the pump housing must likewise be fully serviceable. In particular there must be no score or scratch marks between the two passage outlets. If dirt is found, clean with a wooden stick and a leather cloth.

Place the key in position and install the impeller in such a way that the inclined part of the vanes points toward the pump housing. Use a new O-ring and reinstall the pump cover in its previous position.

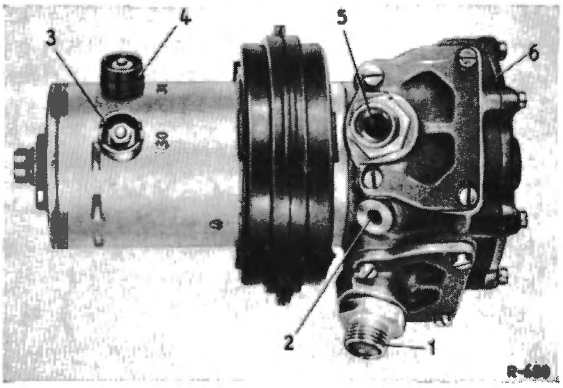


Fig. 00-15/7

1 Threaded union with check valve (delivery side)
2 Screw plug
3 Terminal 30
4 Terminal 31
5 Threaded union (suction side)
6 Pump cover

Testing of Check Valve

Test the check valve in the threaded union (1) of the fuel feed pump by blowing air into it.
A leaking check valve in the threaded union (1) (delivery side) can be replaced, but only together with the threaded union.

The threaded union (5) on the suction side has no check valve (see Fig. 00-15/7).

b) Fine Fuel Filter

Clogged filters may be the cause of unsatisfactory starting of a hot engine and of uneven running of the engine. If the engine falters at high rpm, this may also be due to a clogged fuel filter.

To check the fuel filter for dirt follow the procedure outlined for checking the delivery pressure. Only cellular paper filter elements may be installed (see Fig. 07-10/16).

c) Damper Units

If fuel noise occurs in the pipes, check the diaphragm of the damper units. Cracked and damaged diaphragms should be replaced.

During assembly the following points should be noted:

To improve sealing between housing and cover, a groove has been cut into the sealing surface of the housing (5) (Fig. 00-15/8). On the first version installed in Model 220 SE, in addition to the groove in the housing, a rim was added to the sealing surface of the cover (4). Furthermore, in this version a paper gasket (9) was added between housing and cover to prevent excessive pressure on the diaphragm by the rim on the cover; without the gasket it might tear. In no case, however, must a paper gasket be used in the 2nd version of the damper unit with a rimless cover since that would decrease the pressure on the diaphragm too far.

Where a cover with rim is installed it is advisable to replace it by a cover with smooth sealing surface.

When a threaded union is replaced make sure that a proper new union is fitted. Fig. 00-15/8 shows the damper unit for the feed line (from the fuel filter). In the damper unit for the return pipe the threaded, union (7) has a 6 mm bore and the threaded union (8) a 3.5 mm bore on Models 220 SE and 220 SEb and a 2.0 mm bore on Model 300 SE.

The threaded unions must not be installed with sealing compound or sealing grease, since there would be a danger of such particles getting into the gasoline system and damaging or impeding the proper functioning of the injection system.

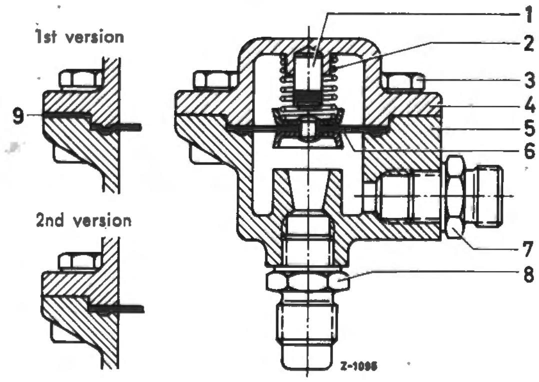


Fig. 00-15/5

1 Plug
2 Pressure spring
3 Hexagon screw with spring washer
4 Cover
5 Housing
6 Diaphragm
7 Threaded union with sealing ring (outlet)
8 Threaded union with sealing ring (inlet)
9 Paper Gasket

d) Electro-Magnetic Cold Start Valve

It often happens that cold start valves are unnecessarily removed from a vehicle or replaced only because e. g. on the 1st version of the start valve fuel drops appear between the electric magnet and the valve housing or in the connecting hose between the start valve and the intake pipe.

a) **If there is an outside leak** between the electric magnet and the valve housing replace the rubber ring (3). To do this screw off the electric magnet and replace the rubber ring (3) Part No. 001 997 78 40 on the 1st version, Part No. 001 997 75 40 on the 2nd version (Figs. 00-15/9 and 00-15/10).

b) **In the case of inside leaks** always make a leak check. A slight loss of gasoline of 0.3 cc/min at a gasoline pressure of 0.5 to 0.6 atm is permissible. Such a small leak has no influence on the engine, that is on gasoline consumption and idling performance.

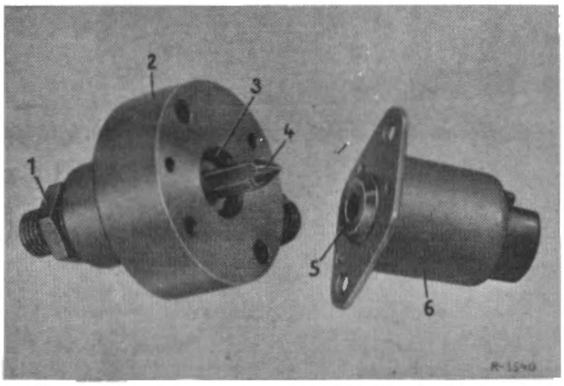


Fig. 00-15/9

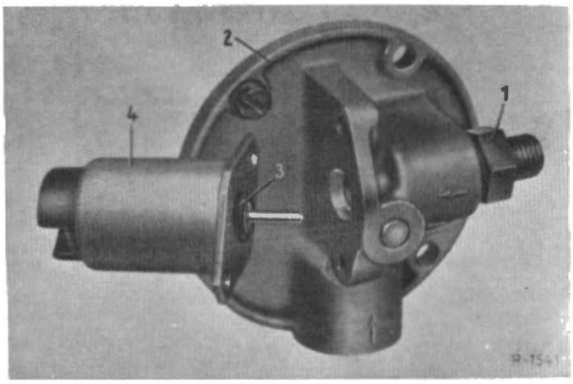


Fig. 00-15/10

Start Valve

1st Version

1 Threaded union
2 Valve housing
3 Sealing ring
4 Valve cone holder
5 Bushing
6 Electric magnet

2nd Version

1 Threaded union
2 Valve housing
3 Sealing ring
4 Electric magnet

Leak checks can be made as follows using the checking device Part No. 111 589 13 21 00 consisting of a measuring tube (1) (glass tube with 0.1 cc graduation), a connecting pipe (3) with a cap nut and a length of hose (2) (see Figs. 00-15/11 and 12):

On the 1st version start valve unscrew the fuel hose from the start valve and instead attach the connecting pipe (3) with hose (2) and measuring tube (1) (Fig. 00-15/11).

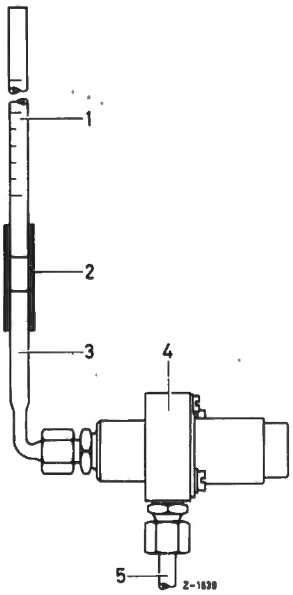


Fig. 00-15/11

Start Valve

1st Version

1 Measuring tube (glass tube)
2 Connecting hose
3 Connecting pipe with cap nut
4 Start valve
5 Fuel feed pipe

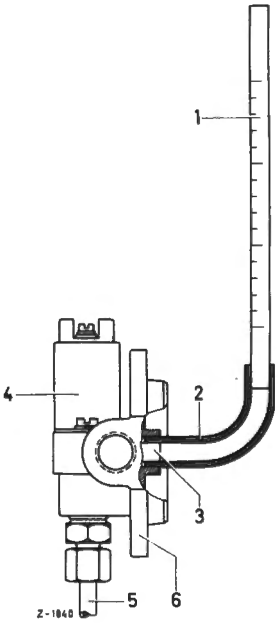


Fig. 00-15/12

Start Valve

2nd Version

1 Measuring tube (glass tube)
2 Hose
3 Atomizing jet
4 Electric magnet
5 Fuel feed pipe
6 Valve housing

On the 2nd version start valve unscrew the start valve from the intake pipe. Slide the hose (2) with the measuring tube (1) over the atomizing jet (3) (fig. 00-15/12).

Switch on the ignition. Connect a cable to the positive terminal of the battery. Open the start valve for a short time by establishing contact by means of the cable connected to the battery until a fuel column is visible in the measuring tube (1).

Now measure the rise of the fuel column in the measuring tube (1) with the start valve closed during a period of exactly 1 minute. The fuel loss may be as much as 0.3 cc/min; if this amount is exceeded unscrew the threaded union (1) and remove, clean and, if necessary, re-lap the valve (Figs. 00-15/9 and 10). If there is still a leak of more than 0.3 cc/min replacement of the start valve is justified.

Job No.
00-16

Adjustment of Fuel Injection Engine

Modification: Model 230 SL added, Model 220 SE cancelled, text revised

A. Adjustment of Control Linkage

Between the adjustment lever (15) on the injection pump and the throttle valve lever (1) on the venturi control unit there is a certain definite correlation which is of decisive importance for proper engine performance (Fig. 00-16/1).

This correlation must be checked and if necessary adjusted in the case of engine trouble, e. g. jerky running of the car or excessive fuel consumption, and when the control shaft (11), the injection pump, the venturi control unit or the intake pipe has been installed.

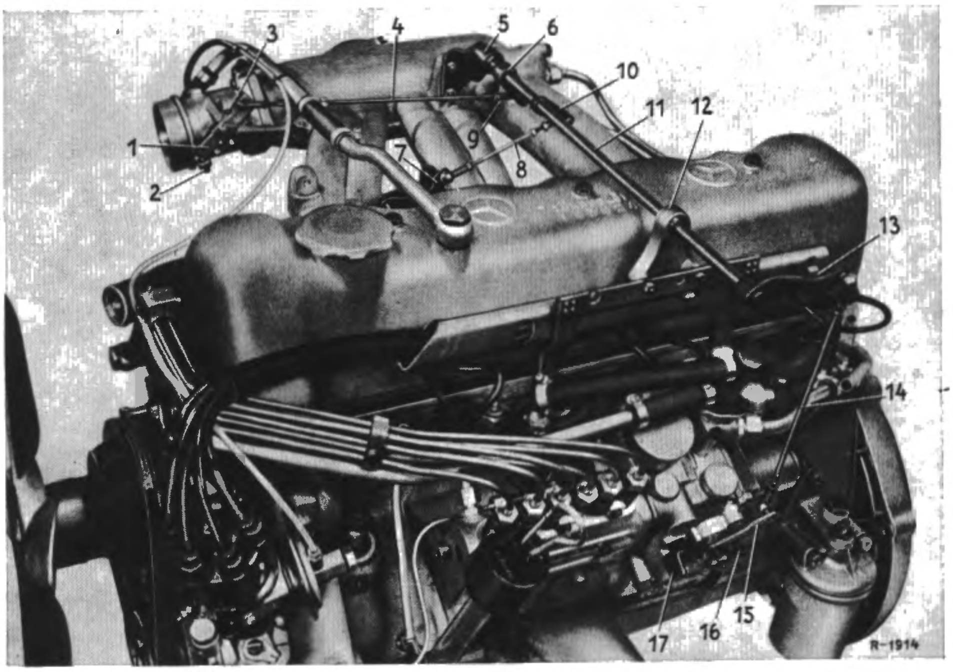


Fig. 00-16/1

Model 230 SL

1 Throttle valve lever
2 Full-load stop screw
3 Idle stop screw
4 Control rod
5 Bearing sleeve
6 Control lever
7 Control lever
8 Control rod
9 Adjusting pin bore
10 Control lever
11 Control shaft
12 Bearing bracket
13 Control lever
14 Control rod
15 Adjustment lever
16 Idle stop
17 Full-load stop

The control linkage can only by checked and adjusted with the help of Adjusting Device Part No. 127 589 01 23 which consists of a graduated disk with pointer and a lever for the injection pump and a plug for the control lever (see Figs. 00-16/2—4). In addition, Graduated Disk and Pointer Part No. 111 589 04 23 are required for the venturi control unit (see Fig. 00-16/5).

For Models 230 SL and 300 SE with six-cylinder pump, the lever (3), which acts as a driver for the graduated disk on the injection pump, must be modified as shown in Fig. 00-16/6 by welding two lugs to the lever and beveling the upper right corner of the lever.

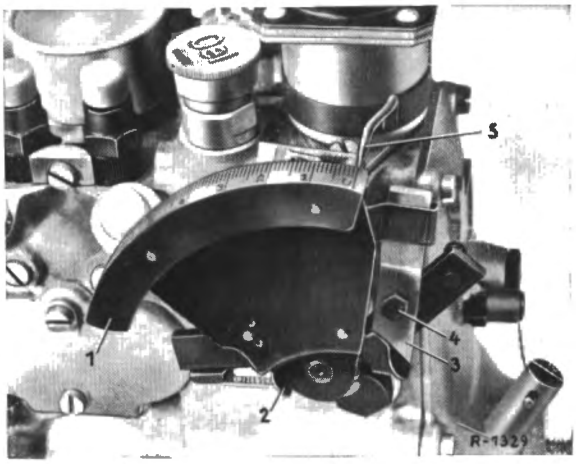


Fig. 00-16/2

ZEB Injection pump
Models 220 SEb and 300 SE

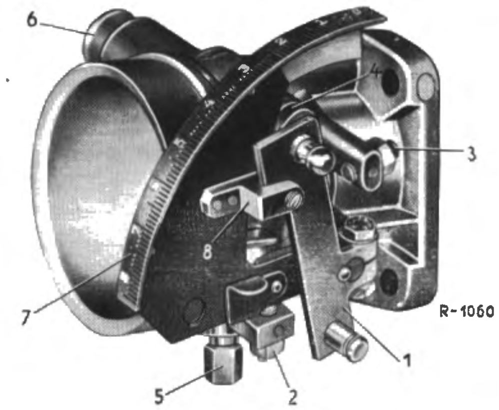


Fig. 00-16/5

1 Throttle valve lever
2 Idle stop screw
3 Full-load stop screw
4 Idle air throttle
5 Vacuum connection for distributor
6 Connection for engine vent line
7 Graduated disk Part No. 111 589 04 23
8 Bracket

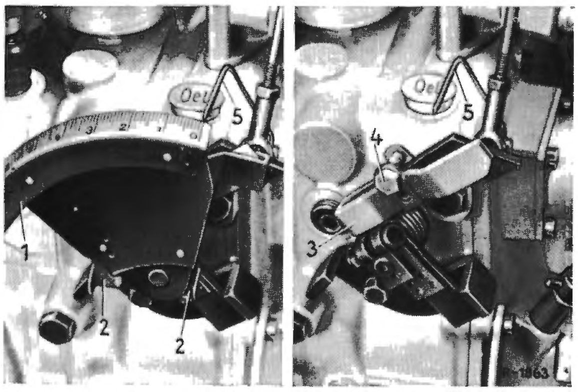


Fig. 00-16/3
Model 230 SL

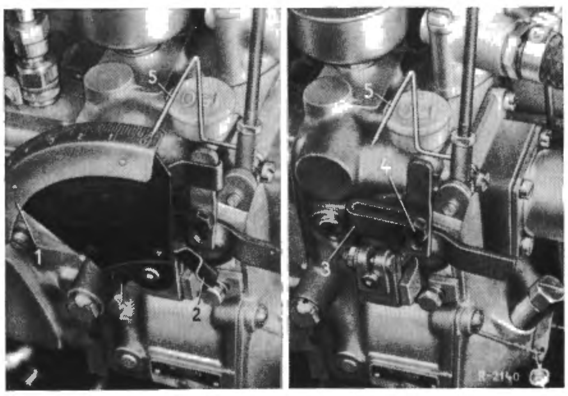


Fig. 00-16/4
Model 300 SE with
six-cylinder injection pump

1 Graduated disk
2 Bracket
3 Lever
4 Hexagon screw
5 Pointer

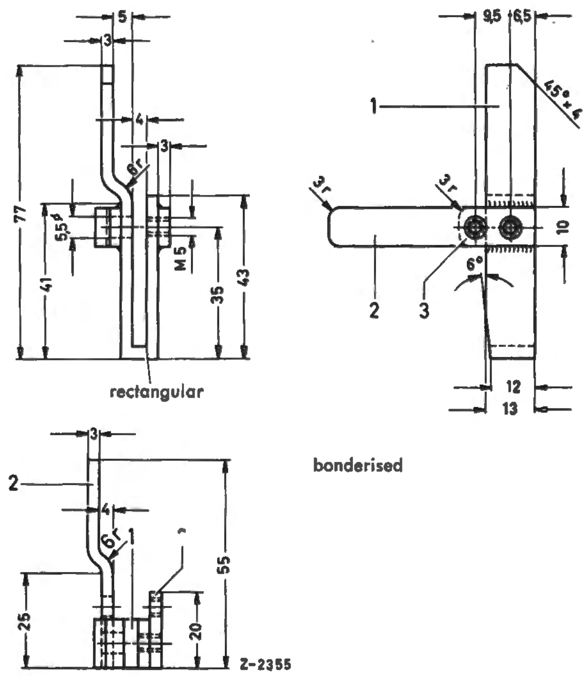


Fig. 00-16/6

modified lever 3

The following procedures are required for checking and adjusting the control linkage:

1. Place Graduated Disk 111 589 04 23 on the axle of the throttle valve shaft and fasten it to the throttle valve lever (Fig. 00-16/5). Then fasten the wire pointer by means of the upper left fixing nut for the venturi control unit and bend it in such a way that **with the throttle valve completely closed** it points to the 0° mark.

Note: On venturi control units with reversed opening of the valve the graduated disk has to be read off starting from the rear.

2. Attach the graduated disk (1) to the axle of the adjustment lever on the injection pump and attach the pointer to a fixing screw of the start magnet. Then bend the pointer to point to the 0° mark when the adjustment lever rests against the idle stop screw (Figs. 00-16/2—4).

3. Actuate the control shaft and adjust the graduated disk on the venturi control unit to the throttle valve angle given in the table and read off the angle indicated on the graduated disk on the injection pump. This angle must be within the tolerances given in the table in the column "control angle". Small differences can be removed by readjusting the control rods (4) and (14). In the full load position the adjustment lever (15) on the injection pump must rest against the full load stop (17), whereas there must be a clearance of about 1 mm between the throttle valve lever (1) and the full load stop screw (2) (Fig. 00-16/1).

4. If the values given in the table cannot be obtained by readjusting the rod or if larger differences are found, the control linkage must be readjusted: Detach the control rod (4) at the control lever (6). Push the adjusting pin into the bore (9) in the lug of the intake pipe thus fixing the ball-head of the control lever (6) in its position. Then adjust the control rod (14) in such a way that the adjustment lever (15) on the injection pump rests against the idle stop (16).

Correlation:

venturi control unit — injection pump on Models 220 SEb and 300 SE

Throttle valve angle	Control angle
0°	0°
2.5	4—4.5
5	8—8.5
7.5	11.5—12.5
10	15.5—16.5
15	22.5—23.5
20	29—30
30	40.5—42
40	50.5—51.5
50	59—60
60	67—68
70	73.5—75
80–82	79—82

Remove the adjusting pin and adjust also the control rod (4) in such a way that the throttle valve lever (1) of the venturi control unit rests against the idle stop (3). Re-attach the control rod (4).
If there is any play between the ball heads of the control rods, control rod (4) should be given a certain amount of initial tension (Fig. 00-16/1).

Note: On the first version of Model 220 SEb the control linkage was installed below. This type of linkage should be adjusted as follows:
In the idle position use a plug to fix the control lever in its position at the left bearing of the control shaft. Then adjust the control rods in such a way that the adjustment lever on the injection pump and the throttle valve lever on the venturi control unit rest against their idle stops. Remove the plug.

5. On engines with progressive linkage check the limit stop of the roller (4) in the quadrant lever (5) and if neccessary adjust as follows:
Adjust the pull rod (3) in such a way that the roller (4) lightly rests against the limit stop in the quadrant lever (5) without exerting any force (Fig. 00-16/7).

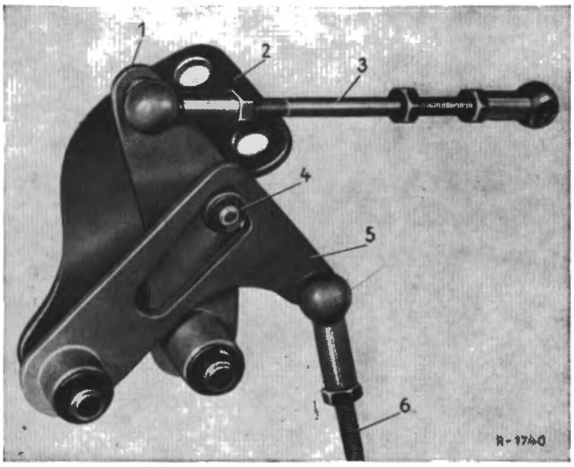


Fig. 00-16/7

Progressive control linkage

1 Control lever	4 Roller
2 Bracket	5 Quadrant lever
3 Pull rod	6 Push rod

6. Some engines of Model 230 SL have been provided with a dashpot. The adjustment of the dashpot should be checked as follows:

   Slowly actuate the control shaft until the control lever (7) is just about to lift from the dashpot pin (6) (Fig. 00-16/8).

   The graduated disk should now indicate a 4° opening of the throttle valve. If this is not the case, the dashpot should be adjusted by means of the hexagon nuts (3) in such a way that the pin (6) lightly rests against the control lever (7) at a 4° opening (Fig. 00-16/8).

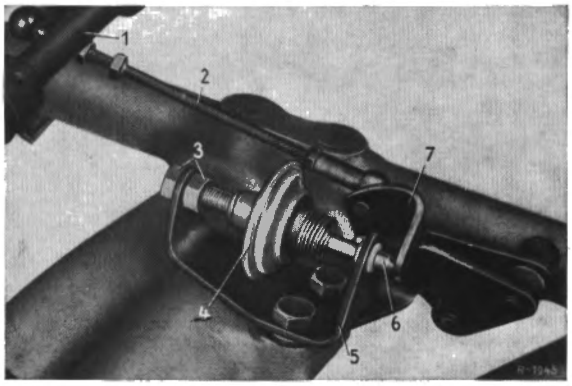


Fig. 00-16/8

Dashpot

1 Control shaft	4 Vacuum box	7 Control lever
2 Push rod	5 Plate	
3 Hexagon nut	6 Pin	

7. Check again as described in para 3. If major differences should be found even then, they may be due to the following causes:

a) Either the control shaft (11) or the ball heads of the control rods are worn. The control rods are bent.

Remedies:

Replace the control shaft or the ball heads of the control rods as required. Straighten or replace the bent control rods. When removing the control shaft proceed as follows:
Pull the control shaft (11) out of the bearing bushing (5) toward the left; if this should prove difficult insert a screw driver between the right control lever (6) and the bearing bushing (5) and press off the shaft. Then unscrew the nuts from the bearing bracket (12) and remove the control shaft together with the bearing bracket (Fig. 00-16/1).

Note: The control shaft must not be forced out of the bearing bushing in an upward direction, since this would damage the snap ring for fastening the ball socket to the control shaft.

b) The idle stop screw on the venturi control unit has been tampered with.

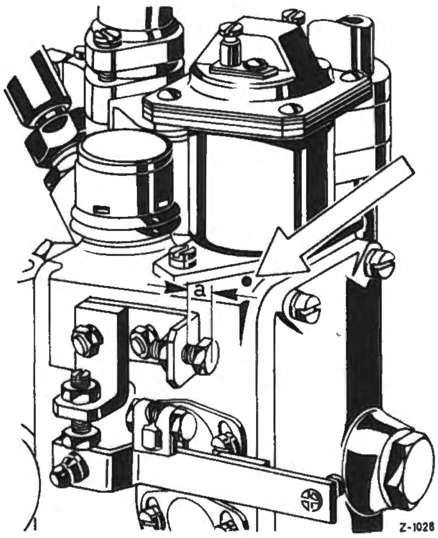
Remedies:

By turning the idle stop screw (3) adjust the throttle valve in the venturi control unit in such a way that with the throttle valve lever (1) resting against the idle stop screw the throttle valve is completely closed without however seizing in the venturi control unit (see Fig. 00-16/1).

c) The idle stop screw on the injection pump has been tampered with **(only on Model 220 SEb with ZEA injection pump).**

Remedies:

The idle stop screw on the injection pump must never be adjusted since this would change the basic setting of the injection pump. In order to make it possible to ascertain whether the



Dimension "a" stamped here

Fig. 00-16/9

ZEA Injection pump

idle stop screw has bee tampered with, the dimension "a" from the angle to the screw head in the pump housing has been stamped beside the start magnet in the ZEA pump version (see arrow in Fig. 00-16/9). E. g. number 95 means that the dimension "a" = 9.5 mm. If the measured value does not correspond to the stamped dimension, an exception can be made to the rule and the idle stop screw may be adjusted to the specified dimension. Injection pumps without the stamped dimension can only be checked and adjusted on an injection pump test bench.

B. Adjustment of Idle

Engine idle can only be satisfactory if the ignition system, the fuel system and the adjustment of the control linkage are in perfect working order. In case of doubt check the following points before adjusting the idle:

Distributor (contact gap – angle of closure – distributor arm),

Spark plugs (specified type – correct thermal value – electrode gap),

Ignition cable harness and ignition lead plug, Interference suppressors (see instructions on interference suppression in spark plug table),

Ignition timing,

Fuel filters (clogging),

Fuel feed pump (delivery pressure or delivery amount),

Adjustment of control linkage,

Injection valves (spray pressure – jet shape – leakage),

Distributor group (minimum cold start amount and even distribution of the fuel amount delivered).

Note on Model 220 SE:

In the case of Distributor VJUR 6 BR 32 T whose centrifugal governor advance curve is at the upper limit of the tolerance range, centrifugal governor advance already begins at a speed of n = 650 rpm. For this reason the ignition point must also be checked at idle speed in the case of engines equipped with a Distributor VJUR 6 BR 32 T. The ignition point must not be in advance of 4° BTDC. If the ignition point occurs earlier, ignition can be retarded as far as 26° BTDC at a speed of n = 3,000 rpm.

In the case of engines whose distributor has too early a centrifugal governor advance and whose idle is not satisfactory even when the ignition has been retarded by 1–2°, the distributor must be replaced. It goes without saying that a Distributor VJUR 6 BR 49 T can be installed instead.

Unsatisfactory idle may also be due to a leak in the intake manifold, the injection valve holders or the vacuum pipe to the ATE Power Brake. When making a leakage test of these parts check whether the vacuum pipe is properly attached to the ATE Power Brake by the hollow screw.

It is possible to adjust the fuel-air mixture for the idle by means of the idle air throttle (4) on the venturi control unit and the spring-loaded idle control knob (6) on the injection pump in such a way that the engine runs smoothly and the desired speed is obtained (see Job No. 00-0 and Fig. 00-16/15). Incorrect composition of the mixture, in addition to causing an irregular idle, may also produce jerky running of the car at low speeds (between 20 and 40 km/h in fourth gear). See also Section "C. Readjustment of Speed Build-Up", b.

Caution! The spring-loaded idle control knob on the injection pump must only be operated when the engine is not running since the knob rotates as soon as it engages in the slot of the adjusting screw on the centrifugal governor (No. 6 in Fig. 00-16/15 and No. 10 b in Fig. 00-16/16).

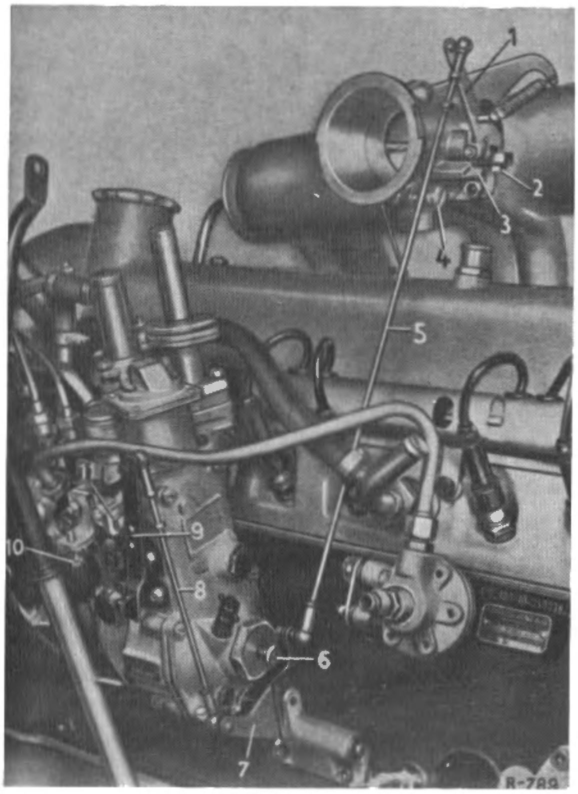


Fig. 00-16/15
Model 220 SE with ZEA injection pump

1 Throttle valve lever	7 Control lever
2 Idle stop screw with lock nut	8 Push rod
3 Full load stop	9 Adjustment lever
4 Idle air throttle	10 Full load stop screw
5 Pull rod	11 Idle stop screw
6 Spring-loaded idle control knob	

With the engine **at working temperature** the adjustment is made as follows:

1. Check the adjustment of the control linkage and if necessary correct (see Section A).

Note: On Model 300 SE detach the control rod (15) at the top before adjusting the control linkage and the idle. After adjustment push the relay lever (5) toward the rear so that it rests against its stop. If necessary correct the length of the control rod (15) so that it can easily be pressed in without moving the relay lever (5) or the lever (13) (see Fig. 00-16/20). The control rod (15) is fitted with a right-hand and left-hand thread.

2. Adjust the idle to the prescribed value by means of the idle air throttle (4) on the venturi control unit (Fig. 00-16/15).

   If the engine runs properly no further correction is necessary.

   If the engine speed fluctuates the fuel-air mixture is too rich. If the engine vibrates the mixture is too lean.

3. **Stop the engine**
   Press in the spring-loaded idle control knob (10b) and turn it until it engages the slot of the adjustment screw (10a) on the centrifugal governor; now turn the knob one notch **to the left if the mixture is too rich,** and turn it one notch **to the right if the mixture is too lean** (Fig. 00-16/6).

Note: The adjustment screw (10a) must only be moved from notch to notch and at the most up to 3 notches to the left or to the right of the basic position (1 notch = 1/6 turn of the adjustment screw). If an adjustment by 3 notches has not produced any result return the adjustment screw to its initial position and check as described in para 4, note.

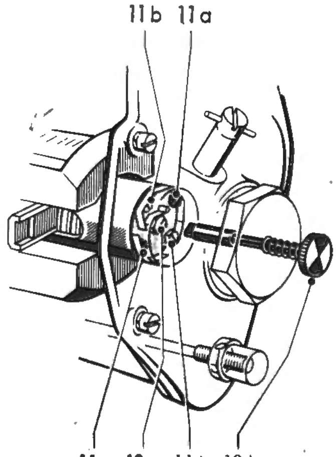


Fig. 00-16/16

Adjustment screws of ZEA injection pump

10a Adjustment screw (black) for idle up to approx. 1000 rpm
10b Spring-loaded idle control knob
11a Adjustment screw (black) for partial load or medium engine speed range from approx. 700 to approx. 4000 rpm
11b Adjustment screw (white) for partial load or upper engine speed range from approx. 2000 rpm

4. Readjusted the idle to the prescribed speed by means of the idle air throttle. If the engine still does not run smoothly repeat the correction until the engine has been properly adjusted.

Note: If the adjustment has taken too long it may be necessary to drive the car a short distance to free the spark plugs.
Unsatisfactory idle may also be due to a leak in the intake pipe, the injection valve holders or the vacuum pipe to the ATE-power brake. When these parts are checked for leaks pay particular attention to the vacuum line attachment to the ATE-power brake by means of the hollow screw.

5. **Checking of Idle Adjustment:**

a) On Models 220 SEb and 300 SE with automatic transmission check the idle engine speed with the selector lever in positions "4" and "R". Apply the hand brake and engage the selector lever. When the selector lever is engaged the idle engine speed must be the same as in lever position "0", i. e. the same as the prescribed idle speed adjusted in accordance with paras 2–4 (see Job. No. 00-0); it may fall by a maximum of 30 rpm.
If the prescribed idle speed is not obtained check the working of the lifting magnet (1) (Figs. 00-16/19 and 00-16/20) and the two oil pressure switches (3) and (4) on the transmission (Fig. 00-16/18).

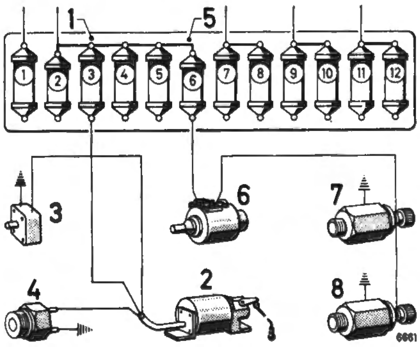


Fig. 00-16/17
Circuit diagram for lifting magnet and oil pressure switch on Model 220 SEb

1 Fuse 3
2 Double lifting magnet
3 Lifting switch (idle switch)
4 Kickdown switch
5 Fuse 6
6 Lifting magnet
7 Oil pressure switch, forward
8 Oil pressure switch, reverse

If the lifting magnet and the two oil pressure switches are in good working order shift the selector lever again to position "4" with the hand brake applied and by adjusting the two nuts (2) (Figs. 00-16/19 and 20) lengthen the push rod of the lifting magnet as much as is required to obtain an idle speed corresponding to that in lever position "0";

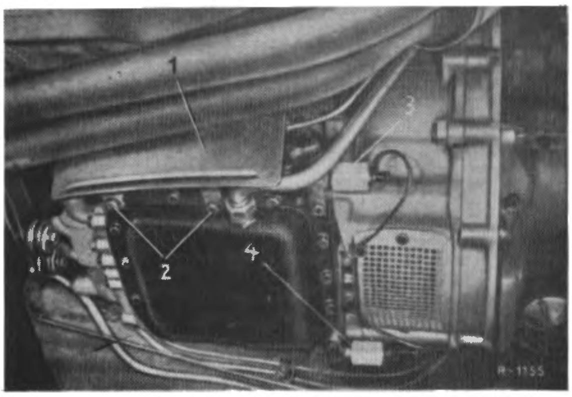


Fig. 00-16/18

1 Baffle plate
2 Fixing screws
3 Oil pressure switch, forward
4 Oil pressure switch, reverse

it may be lower by a maximum of 30 rpm.
Shift the selector lever to position "0". In this position of the selector lever check the idle speed. It must be the same as the idle speed adjusted in accordance with paras 2–4.

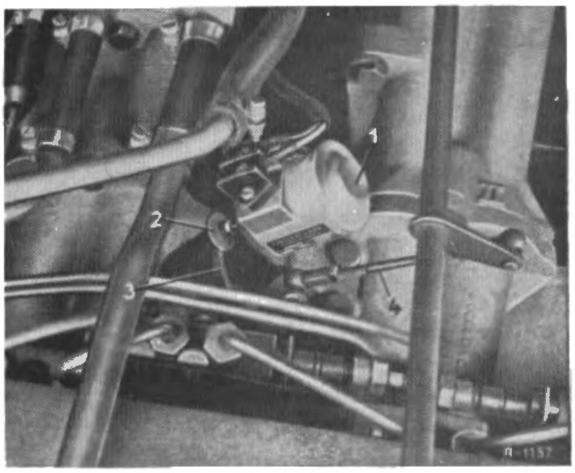


Fig. 00-16/19

1 Lifting magnet
2 Shoulder nut
3 Relay lever
4 Control rod

b) On Model 300 SE with automatic transmission and **power steering** check the idle speed. Apply the hand brake, shift the selector lever of the transmission to position "4" and turn the steering either left or right to full lock. During this operation the idle speed must not fall below 600 rpm. If it is lower loosen the hexagon screw (6) and push it slightly downward in the lever slot (7) and retighten (Fig. 00-16/20). When the screw is moved downward the idle speed of the engine increases, and it falls when the screw is moved upward. If a minimum idle speed of 600 rpm is not obtained

the basic setting should be carried out as follows: Check the operations again as described in Section a. Shift the selector lever to position "0" and adjust the steering to center position. Then check the dimension "a" (see Fig. 00-16/20) from the separating surface of the bracket to center yoke end and if necessary correct. The dimension "a" should be 35 mm. Loosen the hexagon screw (6) and push it into the center of the slot in the lever (7) and retighten.

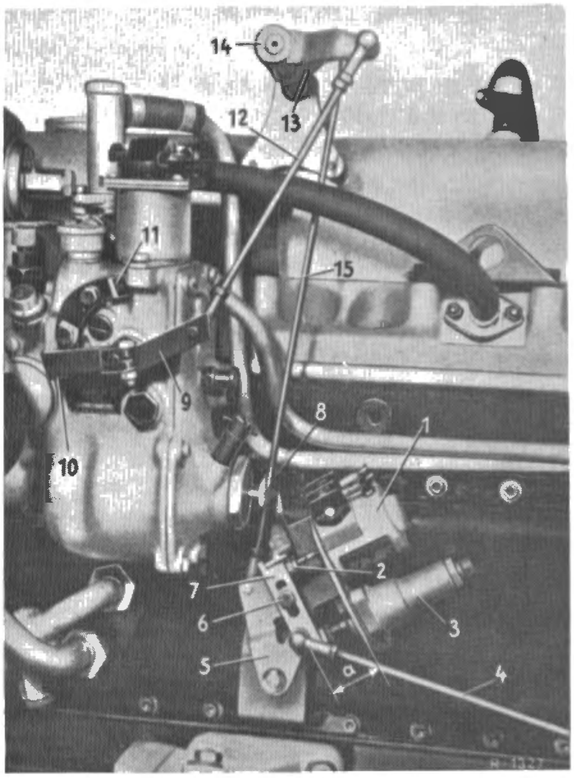


Fig. 00-16/20

Model 300 SE with ZEB injection pump

1 Lifting magnet
2 Hexagon nut
3 Pressure cylinder
4 Control rod
5 Relay lever
6 Hexagon screw
7 Lever
8 Spring-loaded idle control knob
9 Adjustment lever
10 Idle stop
11 Full load stop
12 Control rod
13 Control lever
14 Control lever
15 Control rod
a Distance between separating surface to center yoke end

Detach the control rod (15) at the top, push the relay lever (5) toward the rear until it rests against its stop. If necessary correct the length of the control rod (15), so that it can easily be pressed in without moving the relay lever (5), the lever (13) or the control shaft (Fig. 00-16/20). Then check and if necessary correct again as described in Sections a and b.

6. When the adjustment is completed, the following points, which are of the utmost importance for the idle adjustment, should be checked during a road test:

   a) Accelerate the car to approx. 60–80 km/h, then brake. (Cars with automatic transmission should be accelerated in selector lever position "4"). If after braking and declutching the engine should stall, the fuel-air-mixture is still slightly too rich and the idle speed must be adjusted to the maximum prescribed idle speed. If the engine had been adjusted to this idle speed already the idle adjustment screw on the injection pump can be moved one notch to the left (lean mixture) by means of the idle control knob.

   b) Slightly accelerate the car in 1st gear on a level road, release the accelerator pedal and let the car coast at idling speed. Repeat the procedure in 2nd gear. If the car runs jerkily under these extreme conditions, this may be due to too rich or too lean a mixture. Adjust the mixture accordingly.

Note: The road test as described under b only applies to cars with a mechanical transmission.

   c) Idle adjustment and road test should be repeated until the idle is satisfactory.

C. Readjustment of Speed Build-up

a) Engine Spit-back During Acceleration of Cold Engine

If the injection pump is correctly adjusted, there will be not spit-back when the cold engine is accelerated. A certain amount of spit-back, which is of no importance however, may accur when the throttle valve is quickly opened at low engine speeds.

On Model 220 SE with R 2 injection pump, spit-back may be caused by a mixture which is too lean for the cold engine. In this case the remedy is as follows: add **one** ground steel washer 0.4 mm thick (Part No. 127 074 00 52) between the cooling water thermostat (39) and the injection pump housing (Fig. 00-16/22). During the warming-up period the engine then receives more fuel and more air and the enrichment cut-off temperature is increased from appr. 60° to appr. 68° C.

On injection pumps ZEA R 2, R 3, R 4, R 6, R 7, and on injection pumps ZEB R 11, R 12, and R 13 the warming-up device is factory-adjusted to a cut-off temperature off appr. 68° C. The washer 127 074 00 52 must therefore not be used for these pumps.

b) Unsatisfactory Speed Build-up with Engine warm

If despite correct idle adjustment, speed build-up is not satisfactory when the engine is warm, the mixture can be enriched in the lower partial load range as follows:

On injection pumps ZEA R 2, R 3, R 4, R 6, R 7 and on injection pumps ZEB R 11, R 12 and R 13 by turning the two **black** partial load adjustment screws (11 a) **to the right** one, two or a maximum of three notches (Fig. 00-16/21). Adjustment of the partial load adjustment screws (11 a) also changes the idle mixture in the high idle speed range. When the adjustment has been made, it is ther efore necessary to check the idle and if necessary to turn the idle adjustment screw (11 a) back.

Note: Since on almost all pumps the first partial-load spring comes into action immediately idling speed is exceeded, it may be impossible under certain circumstances to reduce the idle any further by releasing the pressure of the idle spring or by turning back the idle adjustment screw (10 a).
In that case the only remedy is a compromise between idle and partial-load adjustment.

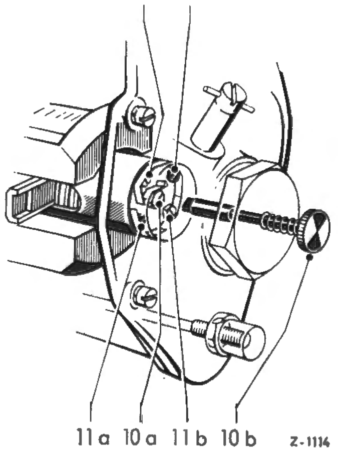


Fig. 00-16/21

Adjustment screws of ZEA injection pump

10a Adjustment screw (black) for idle up to approx. 1000 rpm
10b Spring-loaded idle control knob
11a Adjustment screw (black) for partial load or medium engine speed range from approx. 700 to approx. 4000 rpm
11b Adjustment screw (white) for partial load or upper engine speed range from approx. 2000 rpm

If in the case of a Model 220 SE car whose engine is correctly adjusted and has given no trouble, difficulties occur at high outside temperatures (uneven idle, engine stalling, spit-back during speed build-up), the cause may be too lean a mixture induced by the inlet air thermostat.
In such cases, where the idle and the speed build-up are satisfactory at low outside temperatures and where one of the above-mentioned difficulties occurs at high outside temperatures, the trouble can be overcome by replacing the standard guide bolt by a spring-loaded guide bolt (41 a) (Fig. 00-16/22). By installing a spring-loaded guide bolt, the adjustment range of the inlet air thermostat is limited to 30–35° C (see also Job No. 07-10, Section C, under "inlet air thermostat").

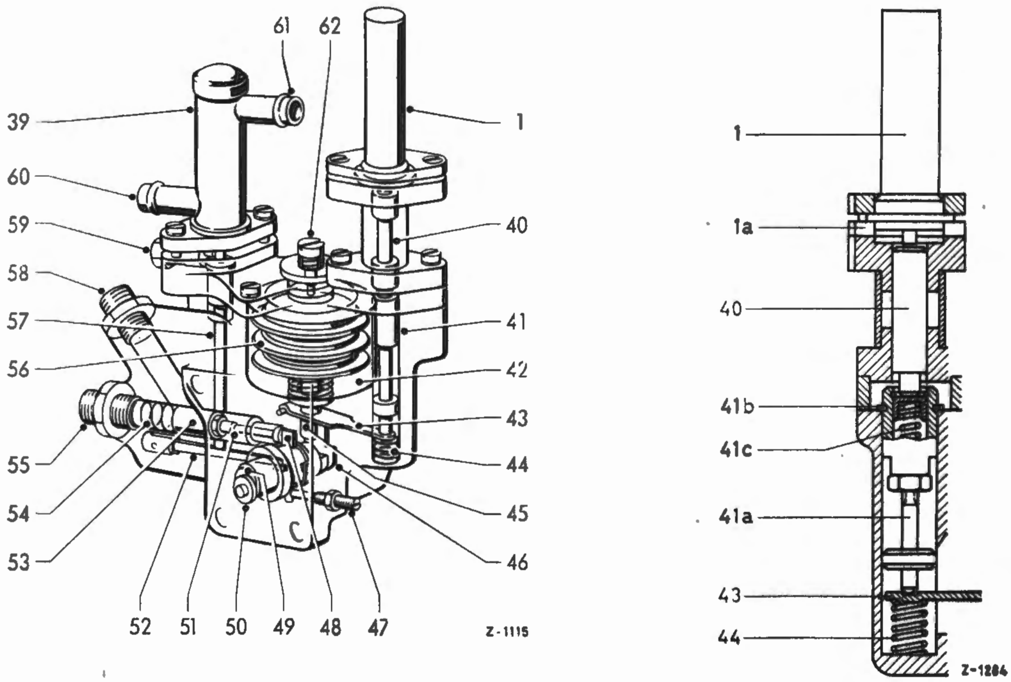


Fig. 00-16/22

Correcting device of ZEA injection pump

1 Inlet air thermostat
1a Insulating flange (as of R 3 Pump)
39 Cooling water thermostat
40 Pin
41 Guide bolt
41a Spring-loaded guide bolt
41b Snap ring
41c Spring
42 Compensator basket
43 Lever
44 Spring
45 Bolt
46 Guide plate
47 Stop screw
48 Drive lug
49 Eccentric bushing
50 Eccentric shaft
51 Guide pin
52 Lever
53 Control slide valve
54 Spring
55 Supplementary-air inlet from air filter
56 Aneroid compensators
57 Guide bolt
58 Supplementary-air outlet to intake manifold
59 Stop bolt for cooling water thermostat
60 Cooling water inlet
61 Cooling water outlet
62 Stop screw for inlet air thermostat

When installing the spring-loaded guide bolt proceed in the case of the ZEA pump as follows:

1. Remove the inlet air thermostat (1) together with the intermediate flange and the pin (40) (Fig. 00-16/22).
2. Take out the guide bolt (41) and measure the distance "a" (Fig. 00-16/22 and 23). Then adjust the spring-loaded guide bolt (41 a) to a length exactly corresponding to this distance, making the measurement between the two contact surfaces. To do this, loosen the lock nut and turn the head part until the distance "a" is obtained. Tighten the lock nut and check the distance "a" again.
3. **Check to make sure that the stop screw (62) is in its normal position (anti-clockwise against the stop) (Fig. 00-16/22).**
4. Install the spring-loaded guide bolt (41 a), which has been adjusted to the correct length, into the housing and attach the intermediate flange by means of the pin (40). Then push down the guide bolt untill the snap ring (41 b) of the spring-loaded guide bolt rests against the housing without exerting pressure on the piston of the guide bolt.
   Then measure the distance "b" (On the first 90 models of the R 3 pumps, include the thickness of the insulating flange in the measurement). Deduct 6.5 mm from distance measured. The difference then corresponds to the thickness of the shims (41 d) to be installed below the snap ring (41 b) of the spring-loaded guide bolt (Fig. 00-16/23).
   The shims (41 d) may be installed with a tolerance of –0.25 mm.
   Suitable shims are available in three different thicknesses:

   0.8 mm thick, Part No. 127 074 03 52
   0.3 mm thick, Part No. 127 074 02 52
   0.1 mm thick, Part No. 127 074 01 52
   The spring-loaded guide bolts has the Part No. 000 141 00 69.

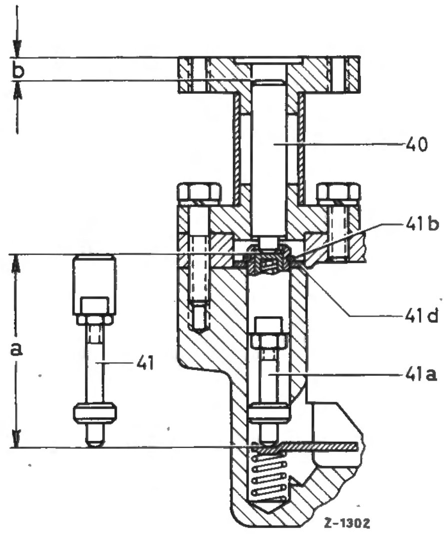


Fig. 00-16/23

Position shown at 30° C air temperature. There is no play between housing or shims and the snap ring. Distance "b" = 6.5 + 0.25 mm.

40 Pin
41 Guide bolt
41a Spring-loaded guide bolt
41b Snap ring
41d Shim

5. After adding the shims, again measure the distance "b" with the bolt pushed down to the stop. Taking into account the permissible tolerance of 0.25 mm, the distance "b" should be 6.5–6.75 mm.
   Since at an air temperature of 30° C the working pin of all thermostats projects 6.5 mm, the lean-mixture limitation produced by the inlet-air thermostat is fixed at 30 to 35° C on all injection pumps fitted with a spring-loaded guide bolt.
   When the inlet-air thermostat is thus limited in its action, it can influence the composition of the mixture only up to that temperature. At temperatures above 30–35° C, the movement of the working pin in the thermostat is taken up by the piston of the spring-loaded guide bolt.

On the R 3, R 4, R 6 and R 7 Injection Pumps a spring cup is installed as a standard part (see Job No. 07-10). It is only on approximately the first 90 R 3 Injection Pumps that this spring cup is missing. These R 3 Injection Pumps, which are marked with a red dot on the stop screw (62), have a rigid guide bolt which is adjusted 4 mm short. Furthermore the stop screw (62) on these pumps is screwed in as far as the stop and the lever (43) is thus fixed in the 20° C position. R 3 Injection Pumps marked with a blue dot on the stop screw have the spring cup installed.

Note: Apart from the blue dot on the stop screw, injection pumps with a spring cup differ from other pumps by the adjustment screw (44b) (see Figs. 07-10/10b and 10c).

All R 1 and R 2 Injection Pumps as well as all R 3 Injection Pumps without spring cup should be subsequently fitted with a spring-loaded guide bolt when an opportunity presents itself. **The letter "b" (limited travel) should be stamped on the cover of the corrector assembly of all injection pumps subsequently** fitted with a spring-loaded guide bolt.

When measuring the rigid guide bolt (41) on the R 3 Injection Pump, add 4 mm to the dimension "a" since on the first 90 R 3 Pumps, as was mentioned above, the rigid guide bolt was adjusted 4 mm short.

D. Checking Supplementary Air Control Slide Valve

As described in Job. No. 07-10, Section C, the supplementary air and larger amount of fuel required during the warming-up period is steadily decreased until at a cooling-water temperature of obout 65–68° C, enrichment ceases altogether.

If the control slide valve closes the supplementary air canal prematurely, with the fuel enrichment adjusted correctly, the mixture will be too rich. As a consequence the engine will fail to build up speed, especially in the 60° cooling-water temperature range, and may even stall. This can easily be corrected by properly adjusting the control slide valve. Proceed as follows:

1. First determine the colling-water temperature at which the supplementary air pipe is closed. To do this it is necessary to screw off the small air filter on the injection pump. While the engine is warming up, put your thumb on the supplementary air pipe to the injection pump at regular intervals in order to determine the cooling-water temperature at which the air intake is stopped. Since the slide valve travels 1.1 mm in the case of the ZEA pump and 0.4 mm in the case of the ZEB pump when the change in temperature is 10° C, the difference between the cooling-water temperature as determined and 68° C is an indication of the length by which the slide valve must be shortened or lengthened.

Example:

Actual cooling-water temperature = 54° C
Correct cooling-water temperature = 68° C

Difference = 14° C
1° temperature change = 0.11 mm slide valve travel on ZEA pump
= 0.04 mm slide valve travel on ZEB pump
14° temperature change = 14 × 0.11 = 1.54 mm slide valve travel on ZEA pump
= 14 × 0.04 = 0.56 mm slide valve travel on ZEB pump
Consequently the slide valve must be shortened by 1.54 mm in the case of the ZEA pump and 0.56 mm in the case of the ZEB pump.

a) ZEA Injection Pump

2. To remove the slide valve on the ZEA pump unscrew the threaded union (55) and take out the spring (54) (Fig. 00-16/22). Turn in a coil spring with an outside diameter of 12 mm, in the opposite direction to the twist, then lock it by turning it in the direction of twist and pull out together with the slide valve. Do not use sharp-edged objects, such as screws, which would damage the bore.

   Measure the overall length of the slide valve. Then loosen the lock nut and screw the slide valve in until the overall length has been reduced by the previously determined amount, in our example by 1.54 mm. After tightening the nut, check the overall length again.

b) ZEB Injection Pump

In the case of ZEB injection pumps unscrew the cooling water thermostat from the control slide valve housing and measure the distance (a) from the separating surface of the control slide valve housing to the adjustment screw (2) (Fig. 00-16/24). Then pull the notched pin (3) out of the control slide valve housing and the eccentric stop bolt (4) as far as the oil filler screw. Then pull the control slide valve (5) together with the adjustment screw out of the control slide valve housing and, depending on the temperature difference between the cooling water temperature measured and the prescribed value of 68° C, turn the adjustment screw in or out. Turn the screw in if the temperature is below 68° C, turn it out if it is higher.

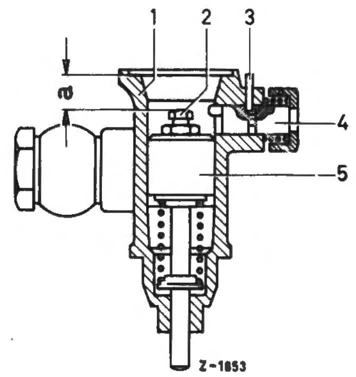


Fig. 00-16/24

Control slide valve housing with control slide valve on ZEB injection pump

1 Control slide valve housing
2 Adjustment screw
3 Notched pin
4 Eccentric stop bolt
5 Control slide valve
a Distance from separating surface control slide valve housing to adjustment screw

3. Before reinstalling the control slide valve check it for ease of movement and if necessary hone it slightly.

4. Reinstall all parts and check whether the slide valve closes at the prescribed cooling water temperature. If necessary correct the adjustment.

   During installation mount the eccentric stop bolt (4) so that the eccentric bolt is at the top. Install the cooling water thermostat with sealing compound.

Trouble Shooting Hints for the Injection System

Job No.
00-18

Before beginning to search for faults in the injection system always check the ignition system. This involves the following:

1. Check the closure angle of the distributor and if necessary adjust the distributor contact gaps (see Job No. 00-0).

2. Check and if necessary adjust the ignition setting with a stroboscope at the specified engine speed and with the engine idling under no load and without automatic vacuum control (see Job No. 00-0).

3. Check the spark plugs (thermal value, electrode gaps, and appearance). Any considerable difference in the spark plug appearance suggests injection valve or distributor fitting trouble.

4. Check the overall resistance of the various ignition circuits; this must not be more than 13 000 ohms.

5. Check and if necessary adjust the correlation between the adjustment lever of the injection pump and the throttle valve on the venturi control unit (see Job No. 00-16). When making this check actuate the linkage from the control shaft in order to eliminate any possible play.

This list makes no claim to completeness. It goes without saying that the battery should be in properly charged condition and that the engine should be using one of the oils specified by us.

Cause	Remedy
Engine does not start	
Fuel feed pump not running	Check electric circuit, if necessary replace feed pump (before installing a new fuel feed pump prime the suction side of the feed pump with approx. 10 cc of fuel).
Fuel feed pump running but inoperative	Prime the suction side of the feed pump, if necessary replace feed pump.
Fuel filter fouled	Replace fuel filter element.
Engine difficult to start when cold	
Incorrect operation	When starting the **cold engine** do not depress the accelerator. As soon as the engine fires, accelerate slowly but release the ignition key only when the engine is firing regularly. If the engine has not started after approx. 10 seconds, give the battery a rest and turn the ignition key back to position "1" in order to overcome the starter locking switch. After a short interval start again, depressing the accelerator at the same time.

Cause	Remedy
Incorrect operation	Once the engine has started quickly depress the accelerator once, then release it in order to prevent excessive engine speeds. Do not put the engine on load before the oil pressure gauge begins to operate.
Supplementary air filter on injection pump fouled	Replace supplementary air filter.
Auxiliary start mechanism failing (for functional details see Job No. 07-10).	Check circuit to start magnet and if necessary replace either start magnet, thermo-switch, or thermo-time switch (depending on start mechanism version, for which see Job Nos. 00-15 and 07-10). Check circuit and fuel supply to starting valve and if necessary replace either starting valve or thermo-time switch or thermo-switch (depending on start mechanism version, for which see Job No. 07-10). Check the electrical system of the start mechanism and if necessary replace relay (see wiring diagram in Job No. 07-10). Check starting valve for dirt and if necessary clean (Job No. 00-15).
Engine difficult to start at temperatures below 15° C and on short runs	
Spark plugs fouled or wet	Install platinum spark plugs and if necessary modify cold start mechanism (see Service Information No. 07-23).
Engine difficult to start when hot	
Incorrect operation	When starting a warm or hot engine the accelerator pedal should be depressed rightaway.
Start magnet or starting valve inoperative	Check circuit and if necessary replace start magnet or solenoid switch on starting valve or (circular) time-switch relay.
Control rod jamming in start position (easily observable after removing the cover cap of the control rod pilot bush on the drive side of the injection pump).	Check whether time-switch relay breaks contact after 1 second, if necessary replace. When the relay breaks contact check whether the start magnet returns to initial position, if necessary replace start magnet (see Job No. 00-15).
Sealing rings between pressure valve holders of the injection pump and pipe unions leaky (only on high-mileage engines, in particular with ZEA pumps).	Check the sealing rings for leaks and if necessary replace (see Job No. 07-13).
Engine does not continue to build up speed in idle when cold	
Control slide valve for supplementary air in aneroid compensator jamming	Free up control slide valve (see Job No. 00-16).
Supplementary air filter on injection pump fouled	Replace air filter.
Magnet valve of auxiliary start mechanism fails to close	Check start valve for leaks and if necessary replace (see Job No. 00-15).
Control rod jamming	Remove cover cap, check control rod for ease of movement, if necessary replace injection pump (see Job No. 07-12).

Cause	Remedy
Uneven idle running with engine warm	
Idle air throttle in venturi control unit not properly adjusted	Adjust idle air throttle in such a way that the engine runs evenly (see Job No. 00-16).
Engine takes in excess air	Check intake pipe, power brake and power brake lines for leaks.
Cooling water thermostat or cooling water feed lines on injection pump blocked or do warm up	Clean thermostat housing and cooling water feed lines.
Cooling water thermostat on injection pump defective	Put thermostat out of action by turning the stop bolt half a turn toward the right (see Job No. 07-10), if necessary replace thermostat.
Magnet valve of auxiliary start mechanism fails to close	Check starting valve for leaks and if necessary replace (see Job No. 00-15).
Injection valves or distributor fittings faulty.	Flush out injection valves and check distributor fittings (see Job No. 00-15). Before installing new injection valves degrease them by flushing them out.
Lubricating oil level in injection pump too high. Excessive oil level prejudices governor function	Check oil level in injection pump, and measure the oil pressure in the engine (should not exceed 7.0 atm at 5,000 rpm and 80° C oil temperature). If necessary shorten the spring of the engine oil relief valve to 40 mm.
Engine stops	
Filter on fuel tank screw plug fouled	Remove filter or screw plug and clean (see Job No. 47-3).
Fine fuel filter fouled	Replace filter element.
Injection valves or distributor fittings faulty	Flush out injection valves and check distributor fittings (see Job No. 00-15). Before installing new injection valves degrease them by flushing them out.
Uneven speed build-up with engine warm (jerky running and spit back)	
Incorrect adjustment of injection pump	Readjust build-up (see Job No. 00-16), if necessary remove injection pump and check or adjust on injection pump test bench.
Noises in fuel lines	
Damper unit defective	Repair or replace damper unit (see Job No. 00-15).
Outward fuel leakage on starting valve	
Seal leaking	Replace seal (see Job No. 00-15).

Removal and Installation of Counterweight and Vibration Damper on Crankshaft

Job No.
03-10

A. Counterweight on Model 190 c

Removal:

1. If the counterweight has to be removed with the engine in the vehicle first remove the radiator (see Job No. 50-1). Release the tension of the fan belts and remove them.

2. Unscrew the stretch screw (8) together with washer (10) from the crankshaft. Remove vee-pulley (9) and counterweight (11) from the crankshaft, using Puller Part No. 186 589 033 300 (Fig. 03-10/1).

Note: Replacement of a damaged counterweight is impossible with the crankshaft installed. For replacement the crankshaft has to be removed and rebalanced together with the new counterweight.

Installation:

3. Fit the counterweight (11) to the crankshaft (13) in such a way that the bores for the cylindrical pins (1) and (12) are aligned. Then drive home the two cylindrical pins (Fig. 03-10/1).

4. Fit on the vee-pulley (9) and tighten by means of the stretch screw (8) and the washer (10) (see Fig. 03-10/1). For tightening torque of stretch screw see Job No. 00-0.

5. Fit the vee-belts and tension them.

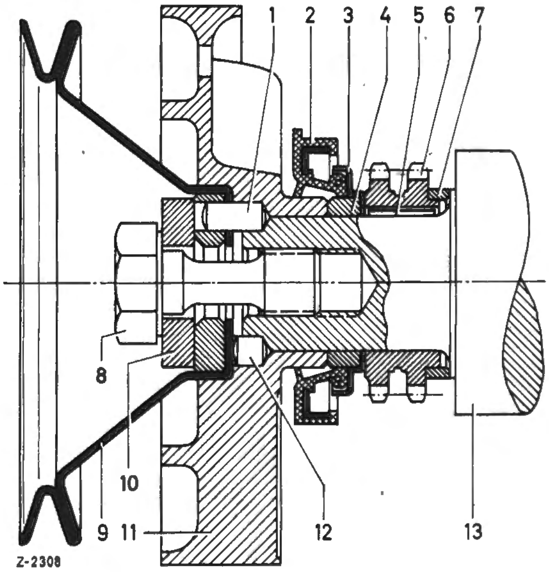


Fig. 03-10/1

1 Cylindrical pin 8h 8×16 DIN 7
2 Oil seal
3 Oil thrower
4 Spacer ring
5 Woodruff key
6 Crankshaft sprocket
7 Compensating ring
8 Stretch screw
9 Vee-pulley
10 Washer
11 Counterweight
12 Cylindrical pin 8h 8×8 DIN 7
13 Crankshaft

6. Install the radiator and fill in cooling water (see Job No. 50-1).

B. Vibration Damper and Counterweight on Models 220 b, 220 Sb, 220 SEb, and 230 SL

Removal:

1. If the vibration damper or the counterweight has to be removed with the engine in the vehicle first remove the radiator (see Job No. 50-1). Release the tension of the fan belts and remove them.

2. Unscrew the three hexagon screws (5) and remove the vee-pulley (2) with the forced-on spacer ring (6) and the vibration damper (1) (Fig. 03-10/2).

3. Unscrew the stretch screw (4) with washer (3) from the crankshaft and pull the counterweight (12) off the crankshaft using Puller Part. No. 111 589 153 300.

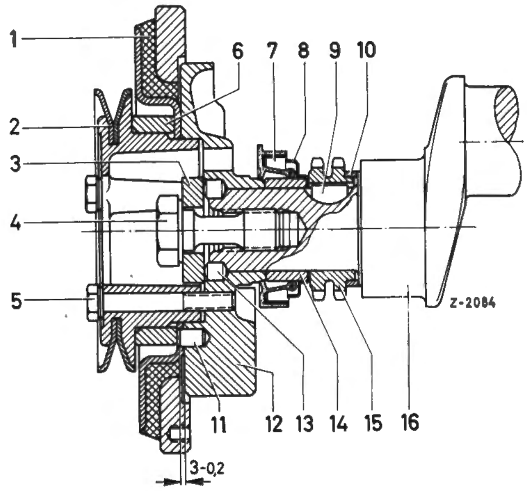


Fig. 03-10/2

1 Vibration damper
2 Vee-pulley
3 Washer
4 Stretch screw
5 Hexagon screw
6 Spacer ring
7 Oil seal
8 Oil thrower
9 Woodruff key
10 Compensating ring
11 Dowel pin 8h 8×12 DIN 7
12 Counterweight
13 Dowel pin 8×8 N 37 b
14 Spacer ring
15 Crankshaft sprocket
16 Crankshaft

Note: Replacement of a damaged vibration damper is possible because the vibration damper is balanced independently of the crankshaft. However, when the counterweight is damaged the crankshaft must be removed and must be rebalanced together with the new counterweight.

On Models 220 b, 220 Sb, 220 SEb, and 230 SL a vibration damper (1) has been installed between the counterweight (12) and the vee-pulley (2) (Fig. 03-10/2). This vibration damper takes the form of a rubber damper. The balance mass and the hub are cemented together by the vulcanised rubber and have been balanced as a unit.

Installation:

4. Fit the counterweight (12) to the crankshaft in such a way that the two bores for the dowel pins are aligned. Then drive in the two dowel pins (13) (Fig. 03-10/2).

5. Screw the stretch screw (4) with washer (3) to the crankshaft.
   For tightening torque of the stretch screw see Job No. 00-0.

6. Drive the dowel pin (11) into the counterweight (12) until it projects by no more than **3 - 0.2 mm.**

7. Fit the vibration damper (1) to the pulley (2) and fit them together to the counterweight (12). The dowel pin (11) on the counterweight should project into the bore in the vibration damper. When the vibration damper is properly seated screw the vibration damper and the pulley to the counterweight by means of the three hexagon screws (5). For tightening torque of the hexagon screws see Job No. 00-0.

8. Fit the vee-belt and tension.

9. Install the radiator (see Job No. 50-1) and fill in the cooling water.

C. Vibration Damper on Model 300 SE

The vibration damper has been arranged on the front part of the crankshaft. It consists of a hub, two contact disks, two flywheel rings, two shear blocks, eight pressure springs, and a flywheel. The hub is fixed in position on the crankshaft by two dowel pins and the flywheel is fixed to the hub by two cylindrical pins (Fig. 03-10/3).

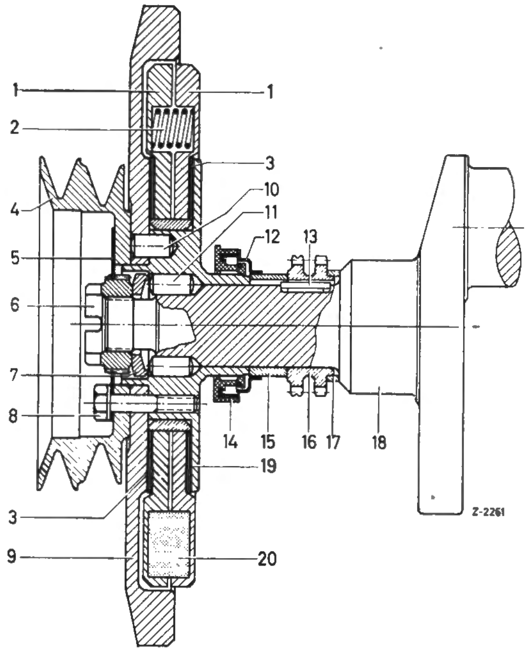


Fig. 03-10/3

1 Flywheel ring
2 Pressure spring
3 Contact disk
4 Vee-pulley
5 Locking plate
6 Tightening nut
7 Thrust plate
8 Hexagon screw
9 Flywheel
10 Cylindrical pin
11 Dowel pin
12 Oil thrower
13 Feather key
14 Sealing ring
15 Spacer ring
16 Crankshaft sprocket
17 Compensating ring
18 Crankshaft
19 Hub with contact ring
20 Shear block

Removal:

1. Remove the radiator (see Job. No. 50-1). Remove the fan mounting bracket (see Job No. 20-3).
2. Clamp the vibration damper together by means of two Clamps Part No. 198 589 01 31 (Fig. 03-10/4). This is necessary in order to ensure that the hexagon screws are relieved when disassembling the vibration damper and that the vibration damper does not come apart.
3. Unscrew the four hexagon screws (8) and remove together with the locking plates and the vee-pulley (4) (Fig. 03-10/3).

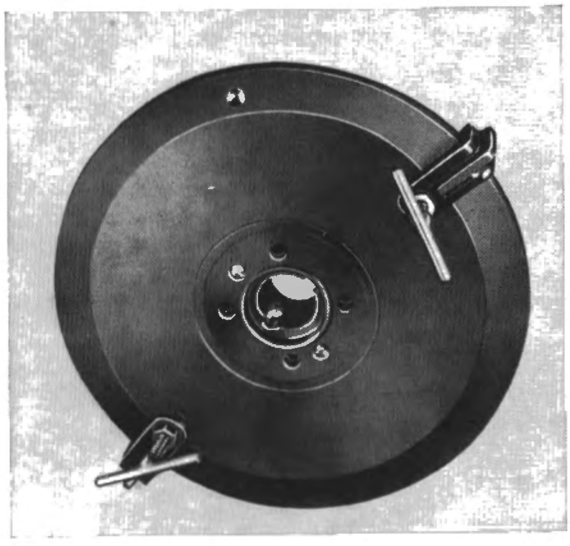


Fig. 03-10/4

4. Use Serrated Wrench Part No. 186 589 00 08 to unscrew the tightening nut (6) and remove the nut together with the thrust plate (7) and the vibration damper from the crankshaft.

Note: If the hub has to be removed use Puller Part No. 186 589 123 300 to pull the hub off the crankshaft.

5. Release the two clamps evenly and disassemble the vibration damper (Fig. 03-10/4).
6. Check all individual parts of the vibration damper (Fig. 03-10/5).

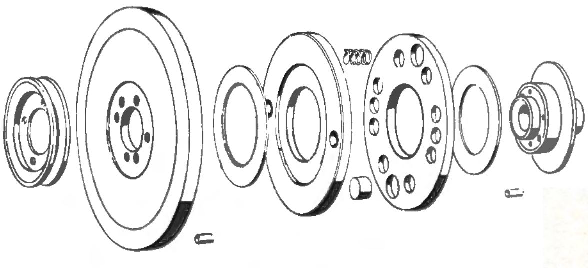


Fig. 03-10/5

Note: If the hub (19) or the flywheel (9) has to be replaced (Fig. 03-10/3) use Hub and Flywheel Part No. 189 030 09 08 which are properly balanced for repair work. In this repair version the hub is fixed in position in relation to the crankshaft with the two half bores and the flywheel is fixed in position in relation to the hub with the two bores.

Installation:

7. If the hub had been removed, drive a dowel pin (11) into one of the half bores of the hub (19) (Fig. 03-10/3). Lightly grease the shaft journal and the hub. Fit the hub to the crankshaft and install by means of Mounting Tool Part No. 186 589 12 61.

8. Check the second dowel pin hole and if necessary ream up. Fit the second dowel pin and drive in by means of a drift. Then drive the two cylindrical pins (10) into the hub.

Note: The hub can also be mounted together with the vibration damper.

9. Reassemble the vibration damper, making sure that the 8 pressure springs and the new shear blocks are properly seated in the holes (see Fig. 03-10/3). Then apply the two clamps and tension them evenly (Fig. 03-10/4).

Note: The contact disks (3) should be installed dry (Fig. 03-10/3).

10. Fit the rear contact disk (3) to the hub and slide the vibration damper on to the hub. The bores in the vibration damper must be aligned with the dowel pins in the hub.

11. Screw in the tightening nut (6) Fig. 03-10/3) and tighten with the prescribed torque (see Job No. 00-0). Take care to ensure that the four bores in the locking plates (5) are aligned with the screw bores. Remove the two clamps.

12. Fit the pulley (4) to the flywheel (9). Install the locking plates (5) and attach the pulley to the hub by means of the four hexagon screws (8) with spring washers (Fig. 03-10/3). Tighten the four hexagon screws (8) with the prescribed torque (see Job No. 00-0).

13. After mounting the vibration damper check the friction torque which should be between 4.5 ad 7 mkg. To do this attach a weight of 10 kg to a lever arm 600 mm long (Fig. 03-10/6).

14. Install the fan mounting bracket (see Job No. 20-3).
Install the radiator (see Job No. 50-1).

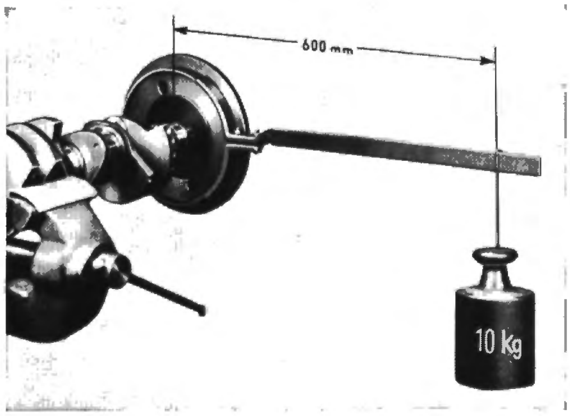


Fig. 03-10/6

15. Run the engine, check the oil level in the automatic transmission, and if necessary top up.

Engine Timing Group 05

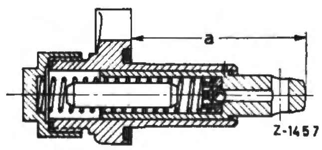
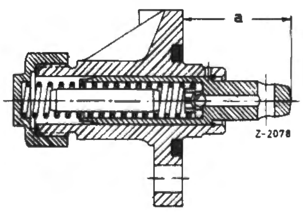
Revolution Counter Group 06

Job No. 05-0

Engine Timing

General Specifications, Data, and Tolerances

Chain Tensioner

Model	Part No.	Dimension "a" (if removed from engine)	
190 c	121 050 05 11	57	 Fig. 05-0/6
220 b, 220 Sb 220 SEb, 320 SL	180 050 06 11	50	
300 SE	189 050 00 11 with three-hole flange and 0-ring seal	37	 Fig. 05-0/7

Removal and Installation of Rocker Arm

Job No.
05-1

Note: The rocker arms for the inlet valves and the exhaust valves are identical.

Removal:

1. Press out the spring clamp (2) from the notch at the top of the rocker arm (3) and push the spring clamp outward over the ball cup of the rocker arm (see Fig. 05-1/1).

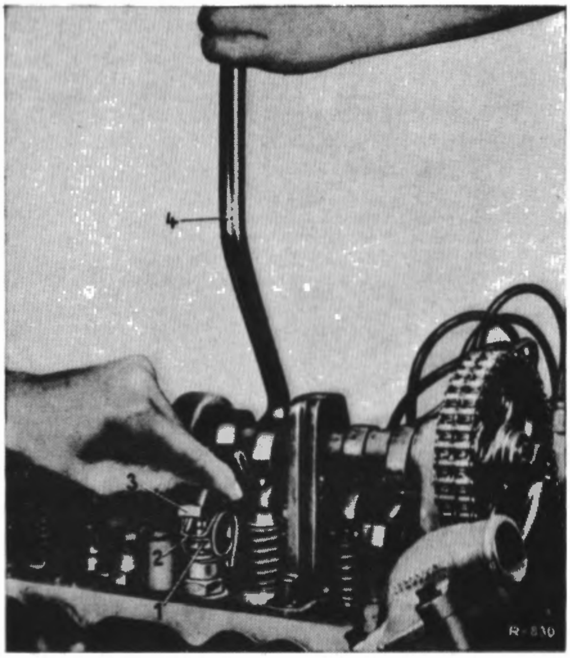


Fig. 05-1/1

1 Ball pin head
2 Spring clamp
3 Rocker arm
4 Special Fool 111 589 01 61

2. Apply Special Tool (4) 111 589 01 61 to the camshaft and to the valve spring retainer and push the valve downward to relieve the rocker arm (3) (Fig. 05-1/1).

3. Lift the rocker arm (3) out of the ball pin head (1) and remove it (Fig. 05-1/1).

Note: Before installation check the sliding surfaces and the ball cup of the rocker arm. Damaged rocker arms must be replaced.

Installation:

4. Apply Special Tool 111 589 01 61 to the camshaft and to the valve spring retainer and push the valve downward until the rocker arm with its ball cup can be placed on the ball pin head.

5. Position the rocker arm.

6. Push the spring clamp over the ball cup of the rocker arm until it engages in the notch of the rocker arm.

7. Check and if necessary adjust the tappet clearance (see Job No. 00-3).

Job No.
05-2

Valve Stem Sealing System

Modification: Valve Stem Sealing System for Models 230 SL and 300 SE added

Models 190 c, 220 b, 220 Sb, 220 SEb, 300 SE

In the case of the inlet valve (8), the valve stem is sealed by means of a sealing-ring retainer (3) with a silicone sealing ring (4). The sealing-ring retainer is pushed over the valve guide and the necessary pressure is provided by the inner valve spring (10) (Fig. 05-2/1 or 3).

In the case of the exhaust valve (8), a sealing-ring retainer (3) in the form of a bell covering the valve guide is soldered to the valve spring retainer (5). The rubber sealing ring (4) is installed in the sealing-ring retainer from below (Fig. 05-2/2).

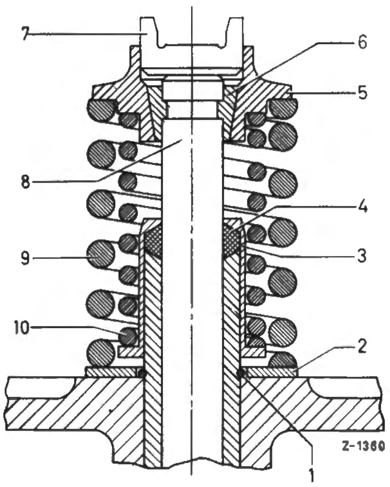


Fig. 05-2/1

Inlet valve
Models 220 b, 220 Sb, and 220 SEb

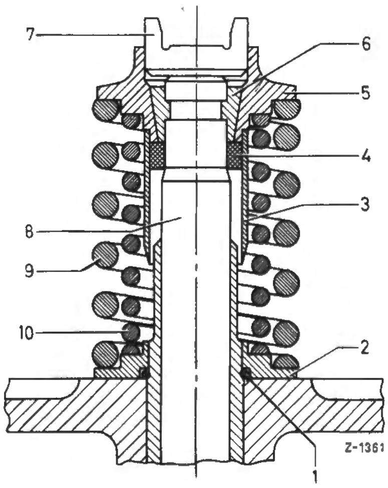


Fig. 05-2/2

Exhaust valve
Models 220 b, 220 Sb, and 220 SEb
Inlet and exhaust valve of Model 190 c

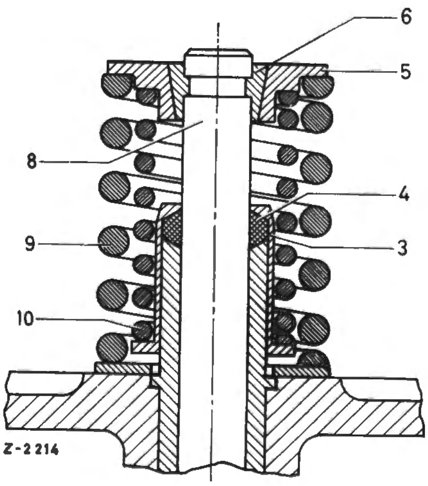


Fig. 05-2/3

Inlet valve
Model 300 SE

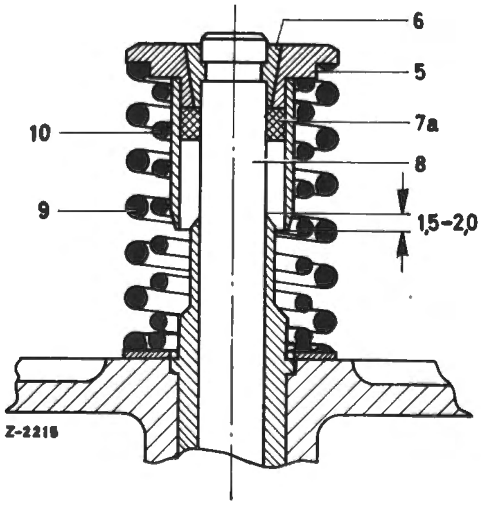


Fig. 05-2/4

Exhaust valve
Model 300 SE

1 Snap ring
2 Washer for valve spring
3 Sealing-ring retainer
4 Silicone sealing ring
5 Valve spring retainer
6 Valve cone half
7 Pressure piece
8 Inlet valve
9 Outer valve spring
10 Inner valve spring

1 Snap ring
2 Thrust collar
3 Sealing-ring retainer
4 Sealing ring
5 Valve spring retainer
6 Valve cone half
7 Pressure piece
8 Outlet valve
9 Outer valve spring
10 Inner valve spring

Note: On the first engines for Models 220 b and 220 Sb there is no difference between the valve stem sealing systems of inlet and exhaust valves (Fig. 05-2/2). The inlet valve stem sealing system shown in Fig. 05-2/1 was installed in these Models as from engine end nos.:

Model 220 b	without	autom. transmission	2162
	with	autom. transmission	0002
Model 220 Sb	without	autom. transmission	4090
	with	autom. transmission	0005

When repairs are carried out, the inlet valve stem seal as shown in Fig. 05-2/1 can be subsequently installed without any difficulty. To do this, it is necessary to replace either the cylinder head or the valve guides.

During assembly the following points need attention:

a) The valves must be free from burr on the groove for the valve cone halves, since this would damage the sealing rings.
b) Remember to install the washer (2) or the thrust collar (2) which serve as the spring seat (Figs. 05-2/1 and 05-2/2).
c) The sealing-ring retainer (3) on the inlet valve (8) must slide over the valve guide smoothly but without any clearance (Fig. 05-2/1).
d) The sealing-ring retainer on the exhaust valve must not descend more than 2.5–3 mm on the valve guide when the valve is closed.
e) The valve cone halves may only rest against the shaft beside the groove at the top and at the bottom, but must not be carried by the groove base.
f) When the valve cone halves are installed, the gap between them should be the same on either side.
g) When assembling the exhaust valve care should be taken to ensure that the valve ring retainer (3) does not foul the inner valve spring (10) (Fig. 05-2/2).

Model 230 SL

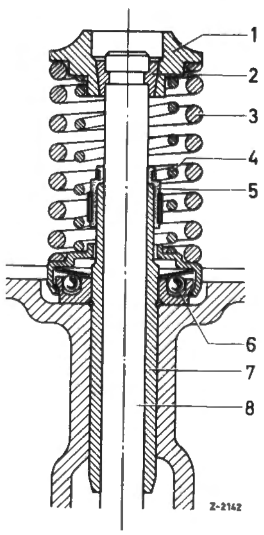


Fig. 05-2/5

Inlet and exhaust valve
Model 230 SL

1 Valve spring retainer
2 Valve cone half
3 Outer valve spring
4 Inner valve spring
5 Teflon sealing ring with clamping ring and strap
6 Valve rotator (Rotocap)
7 Valve guide
8 Valve

Model 230 SL has been provided with a new improved PC valve stem seal consisting of a teflon sealing ring (5) with clamping ring and clamping strap. The inside diameter of this PC valve stem seal is 9 mm for the inlet valves and 10 mm for the exhaust valves.

In order to avoid damage to the teflon ring by the cut groove in the inlet valve when installing the PC valve stem seal, a plastic fitting sleeve Part No. 000 589 166 100, shortened to appr. 10 mm, should be fitted over the inlet valve.

A shop-made installing arbor (see Fig. 05-2/6) should be used to press the PC valve stem seal on to the valve guide of both inlet and exhaust valves.

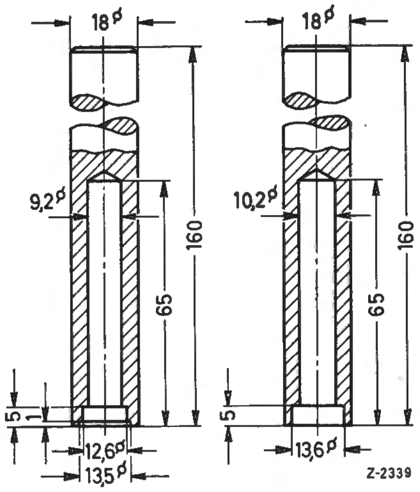


Fig. 05-2/6

Replacing of Valve Stem Sealing System with Cylinder Head Installed

For removal of the valve stem sealing assemblies the pistons concerned should be in the TDC position.

Note: When the valve cone halves of the inlet valves are removed the valve head rests against the piston bottom. On the other hand, because of the compression space in the cylinder head and on Model 300 SE because of the bevelled piston the exhaust valves may project into the compression chamber and therefore the valve must be supported at the valve head by means of a shop-made lever which is inserted in the spark plug hole.
The levers should be made in the shop in accordance with Fig. 05-2/7. For Model 300 SE two levers should be made, lever 1 for cylinders 1, 3 and 5, and lever 2 for cylinders 2, 4 and 6. The rounded side of the lever should be used for Models 190 b, 220 b, 220 Sb, 220 SEb, and 230 SL, and the offset side for Model 300 SE. The offset part of the levers for Model 300 SE should be tested and adjusted on a cylinder head which has been removed from the engine together with the valves.

If the valves are closed it is also possible to hold both intake and exhaust valve steady by means of the cylinder leakage test device CLT-228 or by means of a hose from the compressed air supply to the spark-plug bore, whereby the compression chamber is filled with compressed air, giving the necessary support.

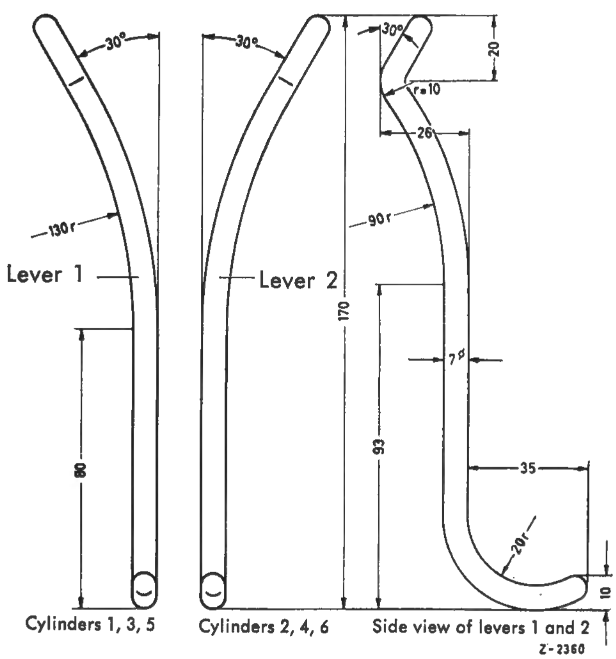


Fig. 05-2/7

Lever for supporting exhaust valves

Removal, Installation, and Bleeding of Chain Tensioner

Job No.
05-10

For fastening to the cylinder head the self-bleeding chain tensioner for the twin roller chain is provided with a two-hole flange for Models 190 c, 220 b, 220 Sb, 220 SEb, and 230 SL and with a three-hole flange for Model 300 SE. On the 1 st version of the chain tensioner a flange seal was installed between cylinder head and chain tensioner. On later models a groove was cut into the chain tensioner housing and an O-ring installed as a seal between cylinder head and chain tensioner. This chain tensioner functions the same way as the tensioner installed in previous engines. In the case of this self-bleeding chain tensioner, any air bubbles that may occur can escape via a short longitudinal groove with the result that the chain tensioner is always well-bled and chain noises are kept at a minimum.

Removal:

1. In order to remove the chain tensioner, take off the cylinder head cover, drain part of the cooling water, and remove the thermostat housing. In addition remove the control shaft between Venturi control unit and injection pump on Models 220 SEb, 230 SL, and 300 SE and on Model 300 SE also remove the guide pulley bracket (see Job No. 13-1).

2. Unscrew the fixing nuts of the chain tensioner and pull out the chain tensioner.

Note: Check the chain tensioner (see Job No. 05-11).

Installation:

3. Before installing the chain tensioner check the flange seal or, on recent chain tensioners, the O-ring. Heavily compressed or damaged flange seals and deformed or damaged O-rings should always be replaced. Chain tensioners with O-ring seals should never be provided with an additional flange seal.

Note: The oil case should always be empty when the chain tensioner is being installed since otherwise the housing may be strained when the nuts are being tightened.

4. Insert the chain tensioner in the cylinder head and evenly tighten the fixing nuts. On Model 300 SE tighten only the lower hexagon nut and install the guide pulley bracket (see Job No. 13-1).

Bleeding:

5. Fill the oil case in the cylinder head with engine oil. Use Bleeder Lever Part No. 187 589 02 63 or, if necessary, a screw driver to push the tension sprocket bearing as far as it will go (see Fig. 05-10/1). Slowly release the lever or the screw driver at the same time filling up the oil in order to ensure that the oil case is always full and the chain tensioner cannot suck in any air. Repeat this procedure until there are no longer any air bubbles on the chain tensioner. When the chain tensioner is properly bled there is no free travel and even at the beginning the tensioner can only be compressed with considerable force.

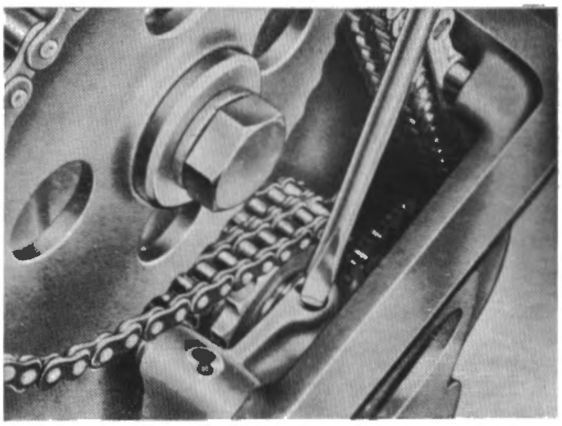


Fig. 05-10/1

6. Install the cylinder head cover. On Models 220 SEb, 230 SL, and 300 SE also install the control shaft between the Venturi control unit and the injection pump and check the correlation (see Job No. 00-16/2, pages 00-16/4 to 16/8).

Job No.
05-11

Checking of Chain Tensioner

Normally, a special testing appliance is required to check the accurate functioning of a chain tensioner. If no testing appliance is available a comparison between the defective chain tensioner and a new one will suffice. For this purpose the chain tensioner is removed, placed in a receptacle, filled up with engine oil, and bled. After bleeding, it should be possible to compress the chain tensioner only very slowly, evenly, and by exerting considerable force.

Chain tensioners which can be compressed easily, usually produce a rattle in the chain. If there is a whine in the chain, it can be assumed that the chain tensioner is not elastic enough.

It is advisable to replace faulty chain tensioners as a complete assembly. If individual parts are obtained for replacement, the pressure pin (9) and the housing (4) must not be exchanged individually since both parts must be selected so as to match perfectly (see Fig. 05-11/1).

Disassembly

1. Unscrew the cap nut (1); please remember that the pressure spring (3) presses against the cap nut (see Fig. 05-11/1).

2. Take the pressure spring (3), the pin (5), the ball retainer (6), the ball (8), and the pressure pin (9) out of the housing (4) (see Fig. 05-11/1).

3. Carefully clean all parts, check for wear and, if necessary, replace (for measurements and tolerances see Job No. 05-0, p. 05-0/4).

Reassembly

4. Insert the pressure pin (9) in the housing (4). Put the ball (8) together with the ball retainer (6), the pin (5), and the pressure spring (3) in the pressure pin (9). Screw on the cap nut (1) together with the sealing ring (2) and tighten (see Fig. 05-11).

5. Fill the chain tensioner with oil, bleed, and check.

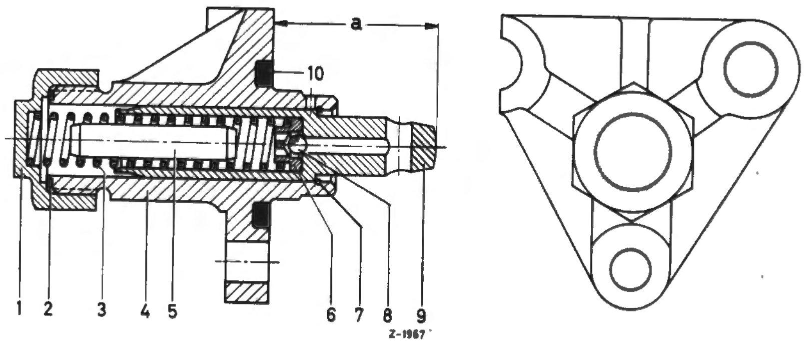


Fig. 05-11/1

1 Cap nut
2 Sealing ring
3 Pressure spring
4 Housing
5 Pin
6 Ball retainer
7 Snap ring
8 Ball
9 Pressure pin
10 O-ring
a = see Job No. 05-0, p. 05-0/4

Removal and Installation of Twin Roller Chain

Job No.
05-15

If repairs should be necessary, a chain with a jointing link (spare link) can be installed as a substitute for the endless chain. This enables the chain to be replaced without disassembling the engine.

When the engine is being overhauled, however, an endless chain should always be fitted.

Removal:

1. Remove the cylinder head cover.
2. Remove the spark plugs in order to facilitate turning of the engine.
3. Remove the chain tensioner (see Job No. 05-1).
4. Remove rocker arm blocks.

Note: It is not absolutely necessary to remove the rocker arm blocks, but this procedure is advisable in order to prevent damage to the valves and the pistons if the roller chain should jump on the timing gear when the engine is being turned to install the chain.

5. In order to remove the old chain grind off the two chain rivets of one link and remove the link. Connect the new chain by means of a jointing link to the old chain and properly install the spring clip (locking clip) (see Fig. 05-15/1).

Note: Install the spring clip in such a way that it cannot be pushed off if it should jam anywhere.

Installation:

6. Put the old chain which is connected to the new chain on the timing gear, slowly turn the engine in the proper direction of rotation and feed in the new chain.

   Feed the chain to the timing gear in such a way that the camshaft is being turned at the same time and that the chain is being tensioned by the crankshaft in the direction of pull. Pull out the released end of the old chain evenly as the new chain is being fed in to ensure that the chain cannot jam.

Note: The crankshaft can be turned over by means of a box wrench SW 22 fitted to the shoulder screw for the pulley attachment. On the Model 300 SE it can be turned over via the bores on the outer diameter of the vibration damper fly wheel.

7. Turn over the crankshaft until the jointing link with the spring clip can be fitted to the other end of the new chain.
8. Lock the new chain by means of the jointing link.

Caution!

Insert the jointing link (2) from front to rear. Insert the spring clip (1) with its closed end pointing in the direction of rotation (see Fig. 05-15/1).

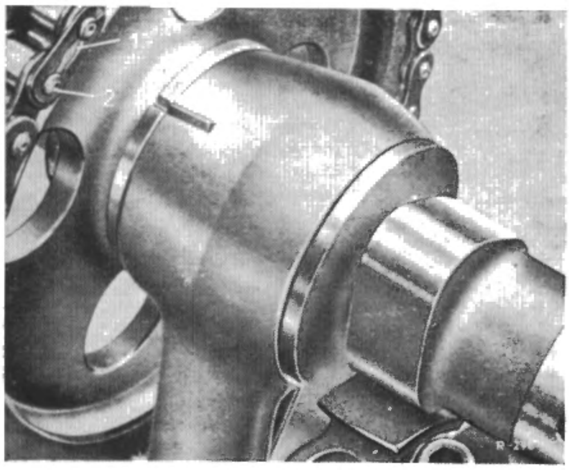


Fig. 05-15/1

1 Spring clip
2 Jointing link (spare link)

9. Install the chain tensioner and bleed (see Job No. 05-1/0).

10. Install the rocker arm blocks and adjust the tappet clearance.

11. Check the adjustment of the crankshaft in relation to the camshaft.

    If the adjustment is incorrect the timing gear must be removed and the chain must be reset on the timing gear by the corresponding number of teeth.

12. Install the spark plugs and the cylinder head cover.

    On Models 220 SEb, 230 SL, and 300 SE also install the control shaft between the Venturi control unit and the injection pump and check the correlation (see Job. No. 00-16, p. 00-16/4-18).

Job No.
06-1

Revolution Counter Drive

The engines of Models 220 SEb Coupé and Convertible, 230 SL and 300 SE Coupé and Convertible are equipped with a revolution counter drive as a standard part.

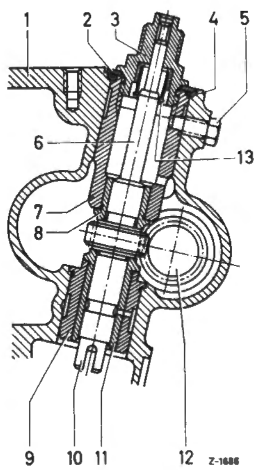


Fig. 06-1/1

Model 220 SEb Coupé and Convertible and 230 SL

1 Crankcase
2 Cover disk
3 Connector for revolution counter drive
4 Rubber ring
5 Hexagon screw
6 Adaptor
7 Pressure piece
8 Bearing bushing
9 Bearing assembly
10 Helical gear
11 Bearing bushing
12 Idling gear shaft
13 Seal

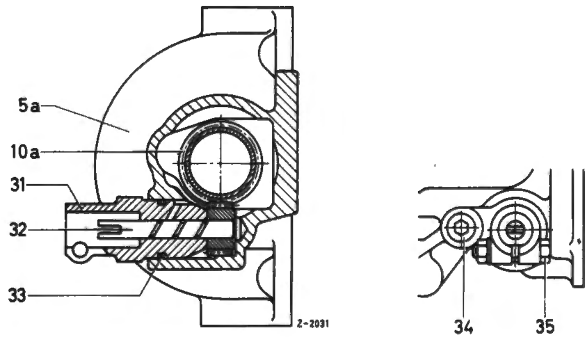


Fig. 06-1/2

Model 300 SE Coupé and Convertible

5a Drive housing
10a Connecting sleeve with helical gear for revolution counter drive
31 Revolution counter drive housing
32 Drive shaft with helical gear
33 Radial seal
34 Hexagon socket screw M 8x60
35 Hexagon screw M 6x30

For subsequent installation in Model 220 SEb use adaptor (6) and connector (3) (Fig. 06-1/1).

For subsequent installation in Model 300 SE Sedan fit connecting sleeve (10a), drive housing (5a), and the housing (31) together with drive shaft and helical gear (32) (Fig. 06-1/2).

Carburetor and Injection System, Fuel Feed Pump
Group 07

Injection System

General Data

Modification: Table taken from Job No. 07-10 and ZEB Injection Pumps added

Injection Pumps

Car model	Injection pump version	Bosch designation of injection pump	Distinguishing features
220 SE Sedan	1	EP/ZEA 2 KL 75 R 1[1])	Cam plate and cam lever have positive connection. Idle adjustment screw nc adjustable from outside. One adjustment screw for total partial load rango
	2	EP/ZEA 2 KL 75 R 2	Cam plate and cam lever have nonpositive connection. Idle adjustmen crews adjustable from outside by means of spring-loaded idle control-knob Two adjustment screws each for lower and upper partial load range.
	3	EP/ZEA 2 KL 75 R 3	Differs from R 2 Injection Pump in insulating flanges fitted between thermo-stats and corrector assembly. Cutt-off temperature for supplementary ai: and mixture enrichment during warming-up period by means of coolinc water thermostat is between 65—68° C (on R 1 and R 2 Injection Pumps a appr. 60° C). Inlet air thermostat with spring cup which limits adjustment by inlet ai: thermostat to 30 to 35° C.
220 SE Convertible and Coupé[2])	1	EP/ZEA 2 KL 75 R 3 Z[2])	Differs from R 3 Injection Pump in modified partial-load and full-loac adjustment.
220 SEb with non-automatic transmission	1	EP/ZEA 2 KL 75 R 4	Differs from R 3 Z Injection Pump only in modified adjustment lever.
	2	EP/ZEA 2 KL 75 R 6	Differs from R 4 Injection Pump in the adjustment lever which is suitab!c for top and bottom control linkage.
	3	EP/ZEB 2 KL 75 R 11[3])	Newly developed Injection Pump without inlet air thermostat, modifiec corrector assembly, modified idle and full-load stop limits and a rec plastic cover and bleeder cap instead of the bleeding filter.
220 SEb with automatic transmission	1	EP/ZEA 2 KL 75 R 7	Differs from R 6 Injection Pump in better control of the warming-up ai and faster idle control (idle speed increase).
	2	EP/ZEB 2 KL 75 R 13[3])	Differs from R 11 Injection Pump in faster idle speed increase.
300 SE	1	EP/ZEB 2 KL 75 R 12	Differs from R 11 and R 3 Injection Pumps in different idle, full-load anc partial-load adjustment by modified control edge, modified cam plate anc modified governor springs.

[1]) If repairs are necessary, have R 1 Injection Pumps converted into R 3 Pumps at a Bosch agency.

[2]) First installed in engine M 127.IV (120 HP), type designation 127.983. Model 220 SE Convertible and Coupé with engine M 127.1 (115 HP) type designation 127.980 has the same Injection Pumps as Model 220 SE Sedan. The R 1, R 2, and R 3 Injection Pumps cannot be replaced by the R 3 Z Pumps.

[3]) On Model 220 SEb the ZEA Injection Pump can be replaced by the ZEB Injection Pump in the case of engines with top control linkage.

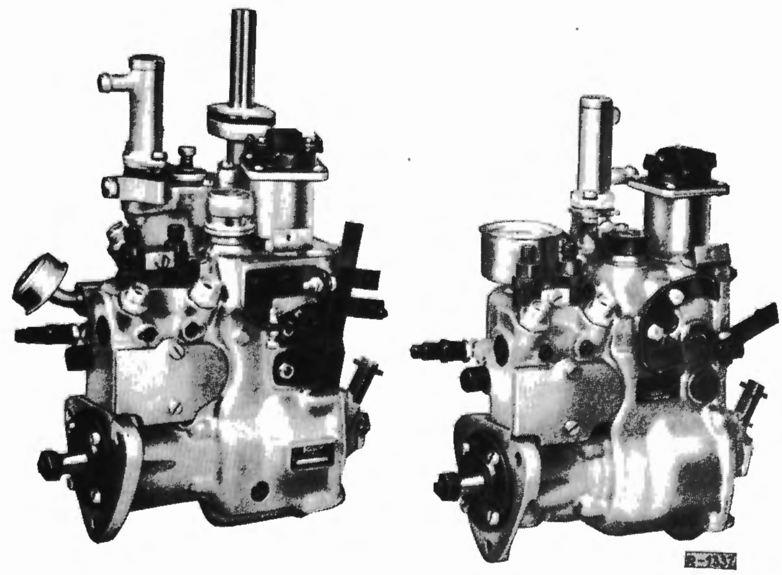


Fig. 07/1

ZEA Injection Pump **ZEB Injection Pump**

Carburetor

Job No.
07-2

1. Model 220 b

The engine of Model 220 b is equipped with **two** Solex down-draft carburetors, type 34 PJCB.
The carburetor 34 PJCB has a suction canal diameter of 34 mm.
The starter mechanism, the idle system and the main carburetor system are the same as in the down-draft carburetor 32 PJCB (previously fitted to model 180a) except that in the mixing tube holder a polyamide ball has been fitted which prevents a flow-back of the fuel to the float-chamber and the stalling of the engine, when the brakes are applied hard.
The accelerating pump used for carburetor 34 PJCB is known as a "neutral" pump (Carburetor 32 PJCB has a mixture enriching pump). With the neutral accelerating pump it is possible for the engine under partial load and full load depending on the depression in the air horn, to draw additional fuel from the pump system by way of the injection tube (15) and the bore (17) without using the accelerating pump (Fig. 07-2/1).

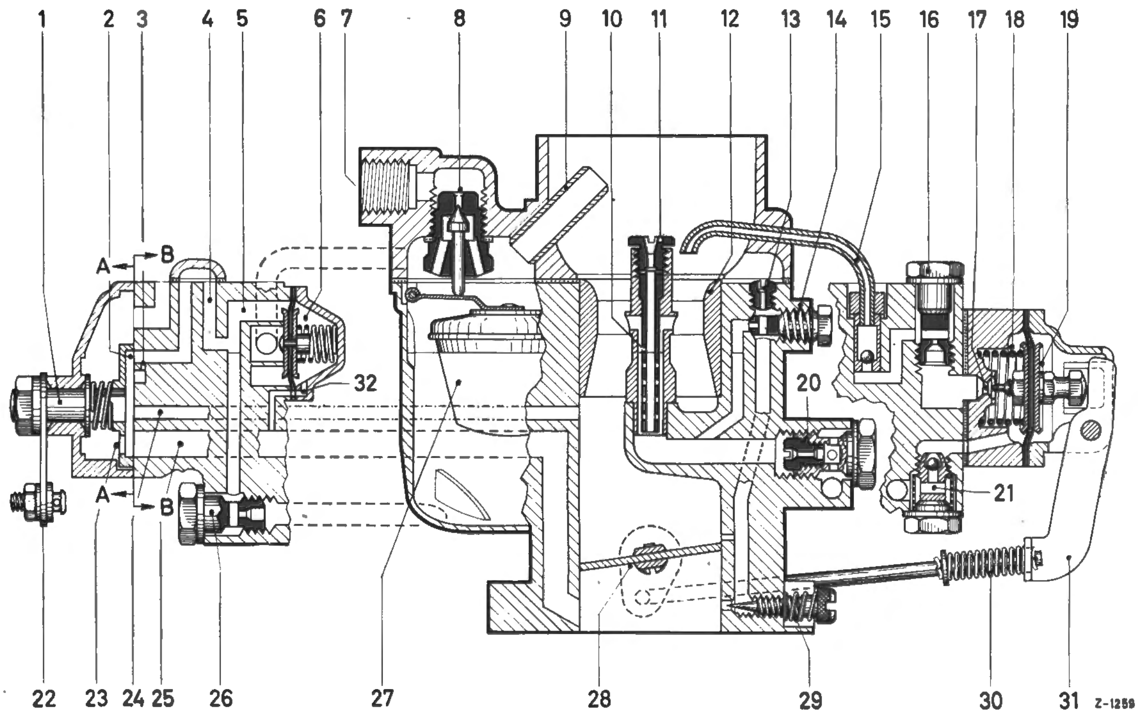


Fig. 07-2/1

Down-Draft Carburetor 34 PJCB
In Model 180 b without polyamide ball, as shown
In Model 220 b with polyamide ball in the mixing tube holder

1 Starter rotary slide valve
2 Graded intake bore in starter flange for fuel canal (4)
3 Graded intake bore in starter flange for fuel slot
4 Fuel canal to starter system
5 Air canal from starter air valve to fuel canal (4)
6 Starter air valve
7 Fuel-line connection in carburetor cover
8 Float needle valve
9 Vent tube for float chamber
10 Mixing tube holder with mixing tube
11 Air correction jet
12 Air horn
13 Idle air jet
14 Idle fuel jet
15 Injection tube
16 Pump jet
17 Bore
18 Diaphragm spring
19 Pump diaphragm
20 Main jet plug with main jet
21 Ball valve
22 Starter lever
23 Starter air bore in starter rotary slide valve
24 Additional air canal
25 Starter mixture canal
26 Starter fuel jet
27 Float
28 Throttle valve
29 Idle mixture adjustment screw
30 Connecting rod with compression spring
31 Pump arm
32 Vacuum canal for starter air valve

2. Model 220 Sb

The engine of Model 220 Sb is fitted with two Solex compound down-draft carburetors with the designation 34 PAJTA which have a suction canal diameter of 34 mm in the first stage. (Carburetor 32 PAJTA in Model 220 S has a suction canal diameter of 32 mm in the first stage). The starter mechanism and the idle system are the same as for compound down-draft carburetors 32 PAJTA.

The accelerating pump is as before a so-called neutral pump, with which it is possible for the engine under partial load and full load, depending on the depression in the air horn, to draw additional fuel from the pump system without using the accelerating pump. In addition, however, the accelerating pump is fitted with a valve which at a throttle valve position of 65–70° is opened by the pin of the pump diaphragm. In this way, when the engine is under full load, additional fuel flows through the check valve (50), the open valve (47), the enriching jet (47a), and through a fuel canal, by-passing the main jet, directly into the mixing tube holder. In throttle valve positions above 65–70° the fuel air mixture is thus additionally enriched (Fig. 07-2/2).

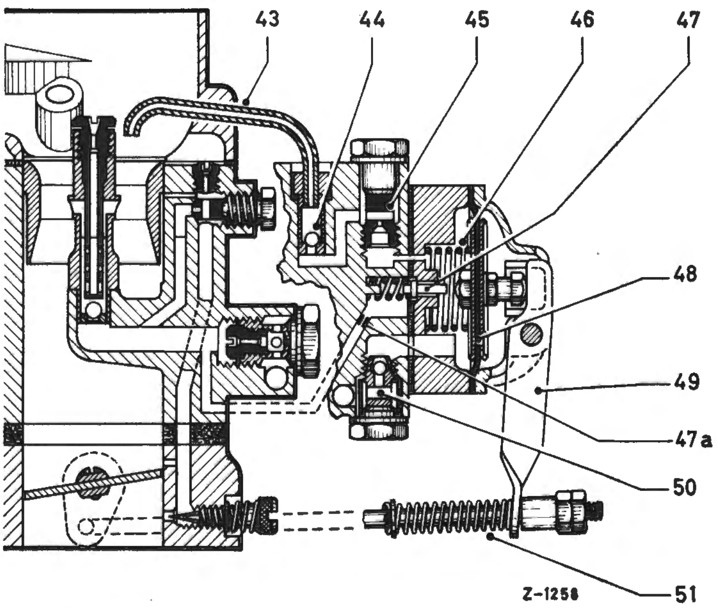


Fig. 07-2/2

43 Injection tube
44 Ball valve
45 Pump jet
46 Diaphragm spring
47 Valve
47a Enriching jet
48 Pump diaphragm
49 Pump arm
50 Ball valve
51 Connecting rod

Otherwise the main carburetor system is the same as that of the previous 32 PAJTA compound down-draft carburetor. For the adjustment of full load enrichment see Job No. 00-11.
In addition carburetor 34 PAJTA has a scavenging device to prevent the formation of vapor bubbles in case of high outside temperatures and slow driving (driving in a line of cars, and driving over mountain passes).

Description of the Scavenging Device

When idling and when the throttle valve is only slightly open, the engine needs very little fuel and consequently the fuel feed pump, because of the free wheel link in the pump arm, does not feed fuel to the carburetor with each stroke of the tappet. In these driving conditions only very little fuel flows through the whole fuel system and thus the danger of vapor bubble formation arises with high outside temperatures.

In order to reach a certain fuel circulation at low engine speeds and under light load, and in particular during idling, a fuel return valve (29) has been attached to the front carburetor, which is connected to the fuel tank by way of the fuel return pipe (30) (see Fig. 00-13/3).

The fuel return valve is operated mechanically by the spring-loaded head of the pump arm (25) of the accelerating pump (26), and the excess fuel runs back through the opened return valve (29) by way of the ring connector and the fuel return pipe (30) to the fuel tank (Fig. 00-13/2). Because of this circulation the fuel is cooled and the formation of vapor bubbles prevented.

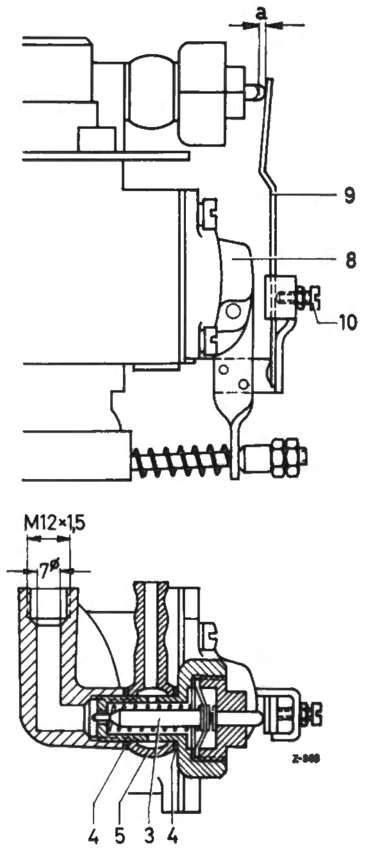


Fig. 07-2/3

Scavenging device on Models 220 b and 220 Sb

3 Valve pin
4 Fiber gasket
5 Ring connector
8 Accelerating pump
9 Spring-loaded pump arm head
10 Adjusting screw
a = 0.4—0.6 mm

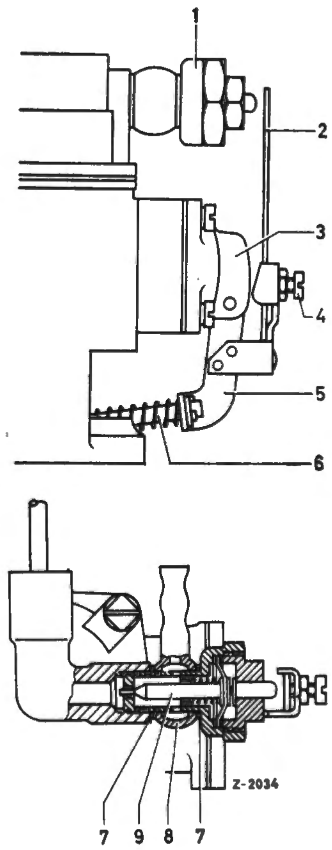


Fig. 07-2/4

Scavenging device on Model 190 c

1 Return valve
2 Spring-loaded the pump arm head
3 Accelerating pump
4 Adjusting screw
5 Pump arm
6 Connecting rod
7 Fiber gasket
8 Ring connector
9 Valve pin

In the idle position and when the throttle valve is only slightly open, the valve pin (3) of the return valve which is fitted with a sealing cone, is pressed outward by the compression spring so that the bore for the fuel flow remains open. When the throttle valves are opened further, the spring-loaded head of the pump arm (9), by overcoming the elastic force, presses the valve pin far enough in to close the bore to the passage of fuel and thus interrupts the scavenging process (Fig. 07-2/3).

Adjustment of the Fuel Return Valve

a) On Models 220 b and 220 Sb

Detach the spring-loaded push rod at the throttle valve lever of the front carburetor. Then back out the idle adjustment screw until the throttle valve of stage one is completely closed. Screw in the adjusting screw (10) on the pump arm until the return valve is completely closed. Then back out the adjusting screw until the valve pin of the return valve has covered the prescribed distance 'a' of 0.4–6.0 mm. Then lock the adjusting screw with the hexagon nut (Fig. 07-2/3).

Note: If the fuel return valve is not properly adjusted, and for this or for any other reason does not close properly, there is a shortage of fuel at higher engine speeds and the car can no longer reach its maximum speed.

b) On Model 190 c

On Model 190 c the scavenging device functions exactly the same way as on the six-cylinder models, the only exception being the adjustment of the fuel return valve. Since Model 190 c is provided with only one carburetor the return valve must close later in order to guarantee proper scavenging in the partial load range On Model 190 c the return valve closes a the end of the accelerating pump stroke.

The Fuel Return Valve should be adjusted as follows:

Push the accelerator linkage until the accelerating pump lever (5) is in its final position. Then turn in the adjusting screw (4) until the return valve (1) is completely closed (Fig. 07-2/4).

Job No.
07-3

Fuel Hose Model 190 c

The fuel hose between fuel feed pump and carburetor consists of a rubber hose with a braided fabric cover and has no screw joints. As a result, this fuel hose has a firm grip when it is under tensile stress. When removing the fuel hose it is therefore necessary to **press** it **off** by means of the washer (2). In no case must the fuel hose be pulled off, for this may force the pipe union out of the carburetor or the pump.

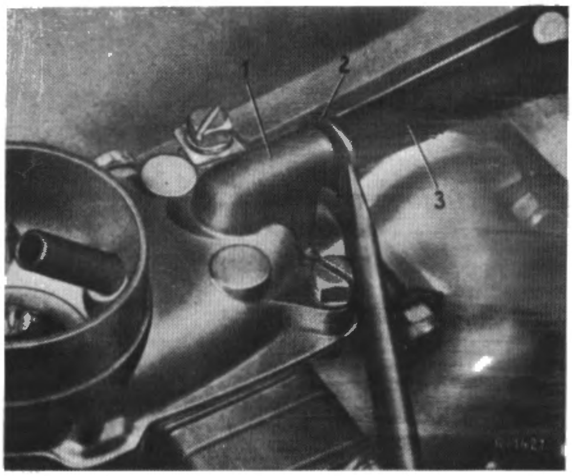


Fig. 07-3/1

1 Carburetor
2 Washer
3 Fuel hose

Removal and Installation of Injection Pump

Job. No.
07-12

Modification: Models 230 SL and 300 SE added

Removal:

1. Remove the battery.

2. Drain off part of the cooling water. Unscrew the cooling water hoses (2) and (6) as well as the supplementary air line (3), oil line (17) and the fuel lines from the injection pump (Fig. 07-12/1 and 07-12/2).

3. Detach the control rod (7). Disconnect the cable from the cold start magnet.

4. Unscrew the fixing nuts (16) and on Models 230 SL and 300 SE unscrew the rear pump bracket and remove the injection pump toward the rear. Remove the coupling sleeve (Figs. 07-12/1 and 07-12/2).

5. If the drive lug on the camshaft of the injection pump has to be replaced the drive lug must be pulled off by means of Puller Part. No. 621 589 00 33. In order to loosen the nut on the camshaft, the drive lug must be held steady with Serrated Wrench Part No. 621 589 00 08. To make room for the puller, two adjacent cheese-head screws for fastening the flange to the injection pump must be screwed out (see Fig. 07-12/3). After having pulled off the drive lug, do not forget to screw the two screws in again.

Installation:

6. Set the crankshaft and the injection pump to installation position.

Models 220 SEb and 300 SE with two-cylinder injection pump.

Set the piston of the first cylinder to TDC (intersection dead center or ignition dead center) and turn the camshaft of the injection pump until the line mark on the camshaft is indexed with the line mark on the flange of the injection pump (Fig. 07-12/3).

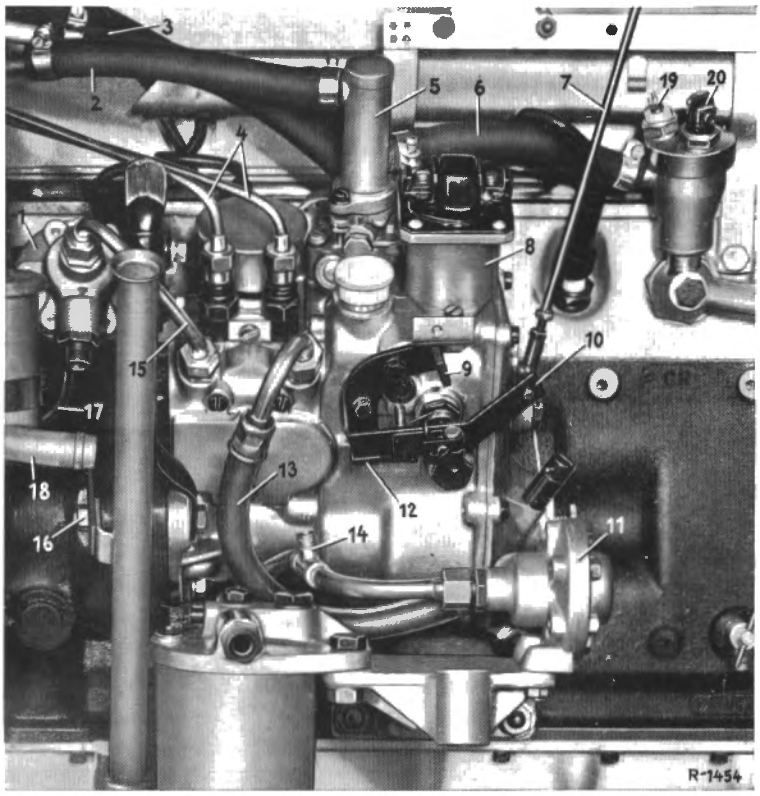


Fig. 07-12/1

Model 220 SEb with ZEB Injection Pump

1 Damper unit (return line)
2 Cooling water hose
3 Rubber hose for supplementary air line
4 Injection pipes
5 Cooling water thermostat
6 Cooling water hose
7 Push rod
8 Cold start magnet
9 Full-load stop
10 Adjustment lever
11 Damper unit (feed line)
12 Idle stop
13 Fuel hose (feed line)
14 Fuel line connection cold start valve
15 Fuel line (return line)
16 Hexagon nut
17 Oil line
18 Oil container for power steering
19 Thermo time switch
20 Thermo time switch

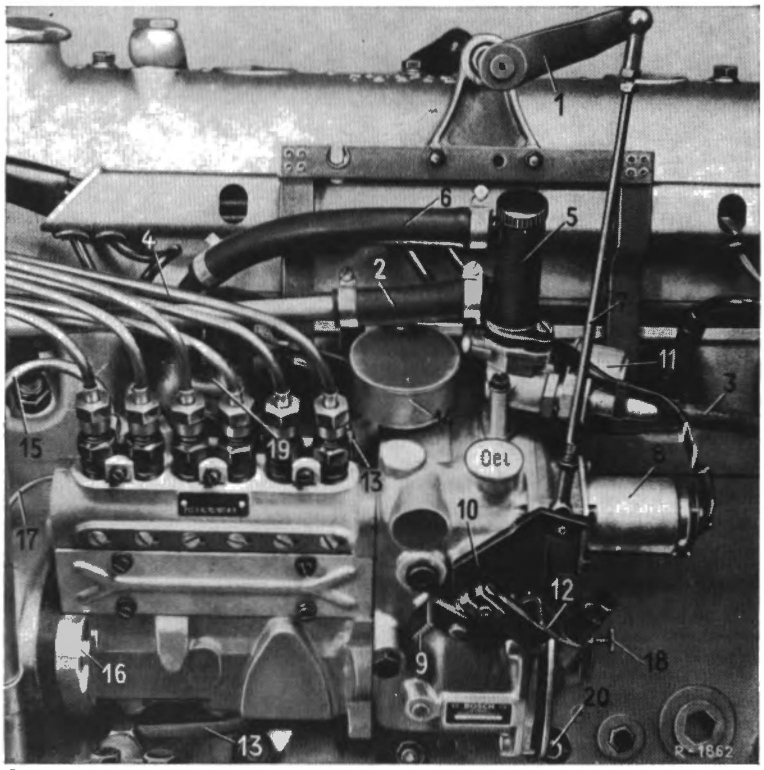


Fig. 07-12/2

Model 230 SL

1 Control lever
2 Cooling water hose
3 Supplementary air line
4 Injection pipes
5 Cooling water thermostat
6 Cooling water hose
7 Control rod
8 Cold start magnet
9 Full-load stop
10 Adjustment lever
11 Air cleaner
12 Idle stop
13 Fuel line (feed line)
14 Aneroid compensator
15 Fuel line (return line)
16 Hexagon screw
17 Oil line
18 Spring-loaded idle control knob
19 Housing for the thermostat switches
20 Hexagon screw

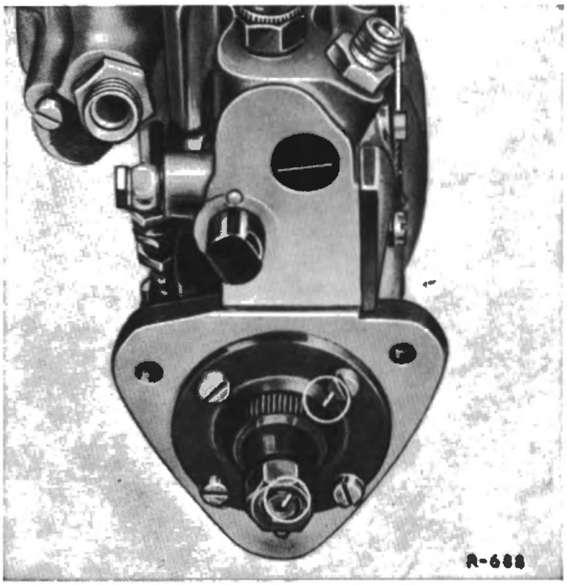
Models 230 SL and 300 SE with six cylinder injection pump

On Models 230 SL and 300 SE with six-cylinder injection pump the injection pipes have been arranged in the reverse order as compared with our previous injection engines, i. e. the injection line from pump element 1 of the injection pump leads to injection valve 6 of the engine, the line from pump element 2 leads to injection valve 5, etc.

Caution: For this reason it is necessary to set the piston of **engine cylinder No. 6** to **20° ATDC of the suction stroke on Model 230 SL and at 60° on Model 300 SE** (1st cylinder 20° or 60° after ignition TDC). Then turn the camshaft of the injection pump until the line mark on the camshaft is indexed with the line mark on the flange of the injection pump.

7. Push the coupling sleeve onto the drive lug and install the injection pump. It is not necessary to check the end of the delivery stroke by means of container and overflow pipe. For this reason the attaching flange of the pump has no slotted holes for correcting the pump position.

8. Connect all lines.



9. Attach the control rod (7) and **check the adjustment of the control linkage** (see Job No. 00-16).

10. Install the battery, top up the cooling water and check the oil level in the injection pump.

11. Warm up the engine and check all lines for leaks; if necessary, tighten up, in particular oil line (17) to avoid loss of oil.

12. Adjust the idle (see Job No. 00-16).

Subsequent installation of ZEB injection pump in Model 220 SEb

On engines with top control linkage the ZEA Injection Pump can be replaced by the ZEB version with the following modifications:

a) Engine with undivided suction pipe

Shorten cooling water hose (6) and, if necessary, replace water hose (2).

Remove the spacer tube from the supplementary air line and fit the rubber hose (3) (Fig. 07-12/1).

b) Engine with divided suction pipe

Shorten cooling water hose (6) and replace water hose (2).

Change the supplementary air line from 10 mm to 12 mm outer diameter; to do this, adjust the rubber hose (3), saw off the line, clean it and solder a 12 mm OD pipe length to the supplementary air line (Fig. 07-12/1).

Job No.
07-14

Adjustment of Injection Pump

Adjustment of Two-Cylinder Injection Pump for USA Cars

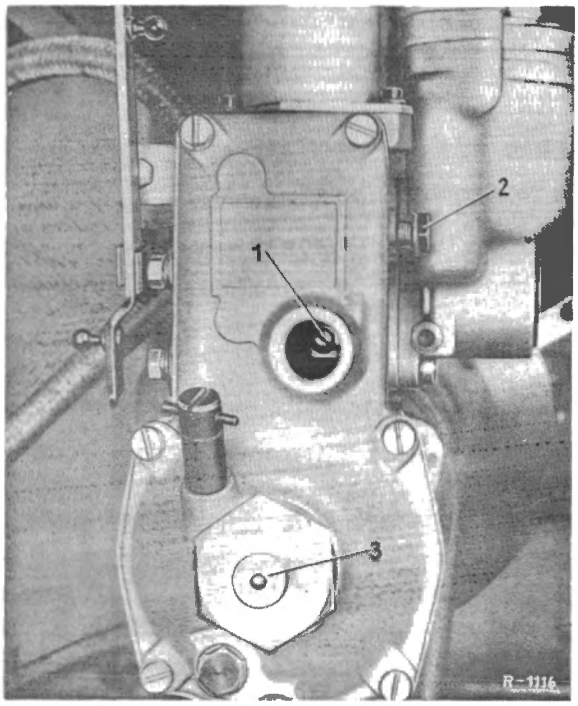


Fig. 07-14/1

1 Adjusting screw on control rod end with screw plug removed
2 Mounting screw for starter lever (backed out)
3 Spring-loaded idle control knob

Since April 5, 1962, all cars of Models 220 SEb and 300 SE supplied to the USA have been adjusted to the specifically lighter premium fuel in our Sindelfingen Works by moving the adjusting screw by 3 notches in the direction "rich".

In order to indicate this adjustment to US premium fuel, the screw plug in the rear control assembly cover has been replaced by a screw plug marked "USA".

This adjustment is not carried out on cars taken over by US clients at our works, and these cars have to be adjusted on arrival in the USA.

To do this remove the hexagon screw plug on the control assembly cover which is lead-sealed by the firm of Bosch, and back out the mounting screw (2) as far as it will go (Fig. 07-14/1).

Now turn the adjusting screw (1) 3 notches toward the left by means of a screw-driver. This increases the injection amount by approx. 1–1.5 mm³/stroke.

Screw on both the mounting screw (2) and the screw plug. Then mark the screw plug "USA" and secure it by means of a DB or Bosch seal.

Note: If complaints are received about USA cars which are temporarily being driven in other countries with standard fuel the adjusting screw should not be touched; the difficulty can be removed by regulating the idle adjustment to provide for a leaner mixture (see page 00-16/6).

If complaints are received about irregular engine performance in the lower speed range on cars previously supplied to the USA, the injection pump can be adjusted accordingly.

Pumps which are repaired in US workshops and are not marked "USA" on the screw plug must be corrected on a test stand for driving with premium fuels after they have been repaired and tested in accordance with Bosch Test Sheets WPP 001/5 DAI 2,2 a to h).

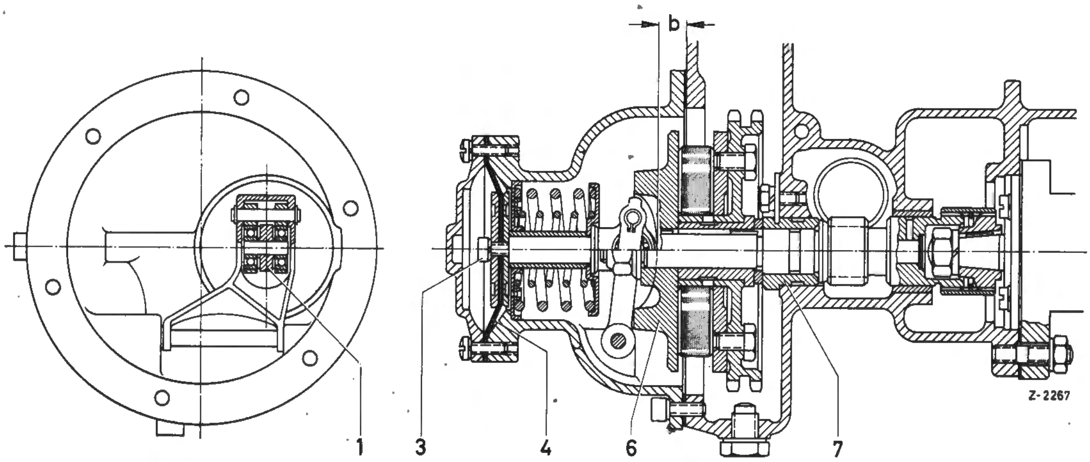
New or exchange injection pumps supplied to the USA should be adjusted by authorized workshops before they are installed in the car and the screw plug should be marked "USA".

Vacuum Pump for Power Brake

Job. No.
07-30

A. General

As from engine number 621 912-10-100 293 or chassis number 110 110-10-099 642 cars of Model 190 Dc have been equipped with a vacuum pump for the power brake as a standard part. The vacuum pump is screwed to the front of the crankcase instead of the cover and is driven by the segmental flange with lifting cam from the spray adjuster.
The front bearing bushing with collar receives the axial pressure of the vacuum pump.



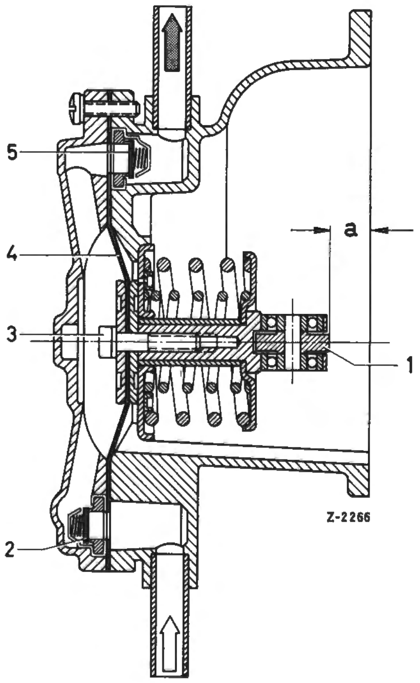


Fig. 07-30/1

1 Roller
2 Plate valve / suction side
3 Cylindrical screw
4 Diaphragm
5 Plate valve / pressure side
6 Segmental flange with lifting cam
7 Bearing bushing with collar

a) Dimension 11.7 — 12.1 mm
b) Dimension 12.92 — 13.8 mm

B. Checking of Vacuum Pump

If brake action is found to be unsatisfactory check the vacuum pump in the car. Install an adaptor with vacuum hose connection for the vacuum gage (Pressure Tester Part No. 000 589 18 31) between the vacuum pump and the power brake.

At average engine speed and after approx. 10 seconds the vacuum gage should register 0.7 atm below atmospheric pressure. If this vacuum is not present the diaphragm may be damaged. A fast decrease in the vacuum with the engine not running suggests leaky plate valves.

For the repair of the vacuum pump a repair set Part No. 000 586 00 43 is available for the inner pressure spring Part No. 000 435 16 84 and the outer pressure spring Part No. 000 435 15 84. At a later date the vaccum pump will be available as a replacement part.

C. Repair of Vacuum Pump

1. Detach the intake and delivery line from the vacuum pump.

2. Unscrew the vacuum pump from the crankcase and remove together with the gasket.

3. Remove the locking device and the lead seal from the Philips screw, unscrew the pump cover and take out the two plate valves (2) and (5) (Fig. (07-30/1).

Note: The two plate valves (2) on the intake side and (5) on the delivery side are interchangeable. If only the plate valves have to be replaced, install the new valves, screw on the pump cover and vacuum pump, and fit the locking device and lead seal to the Philips screw. Re-attach the intake and delivery line.

4. In order to disassemble the vacuum pump or to relieve the two pressure springs screw the shop-made mounting plate with thrust screw (see Fig. 07-30/2) to the vacuum pump and turn the thrust screw until it rests against the roller (1) (Fig. 07-30/1).

5. Unscrew the cylindrical screw (3) while holding the diaphragm disk steady by means of pin wrench Part No. 000 589 00 05 and remove the diaphragm disk together with the diaphragm (4) (Fig. 07-30/1).

Note: If only diaphragm (4) has to be replaced, install the new diaphragm and put on the diaphragm disks. The corrugation on the diaphragm disk should point toward the diaphragm. Coat the thread of the cylindrical screw (3) (M 6x30 DIN 6912-8 G with flat head) with a "Loctite Type A" adhesive and screw in with a new sealing ring, holding the diaphragm disks steady by means of pin wrench Part No. 000 589 00 05. The cylindrical screw (3) should be tightened with a torque of 1 mkg.

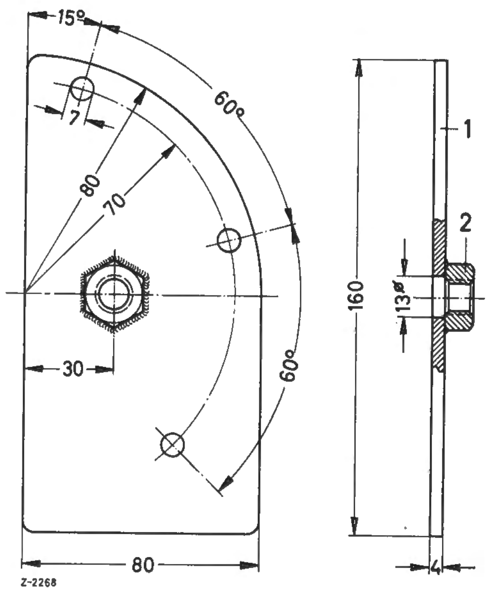


Fig. 07-30/2

Make the mounting plate in accordance with the dimensions given above and weld on the M 12 hexagon nut.
In addition the mounting plate requires:
1 Hexagon screw M 12 × 50 as a thrust screw
2 Hexagon screw M 6 × 50 with nut for fastening the mounting plate to the vacuum pump

6. Relieve the two pressure springs by turning out the thrust screw on the mounting plate and unscrew the mounting plate. Lift the rocker arm with roller and take out the two pressure springs.

7. Before installing the vacuum pump check the dimensions "a" and "b" (Fig. 07-30/1).

8. Reassembly is the reverse of disassembly. When installing the springs take care to make sure that they are properly seated in the spring retainers. Then fit the locking device and lead seal.

Note: The gasket between the crankcase and the vacuum pump is 0.2 mm thick.

Test values of springs

Spring version	Length under load			
	under prelim. load		under final load	
	mm	kg	mm	kg
Outer pressure spring 000 435 15 84	35	12	24	23
Inner pressure spring 000 435 16 84	35	17	24	25

Air Intake Silencer

Group 09

Intake and Exhaust Manifold

Group 14

Air Intake Silencer

Job. No.
09-1

Modification: Models 190 c and 300 SE and Oil Bath Filter (Addition)

A. General

Models 190 c, 220 b, 220 Sb, 220 SEb, and 300 SE have an air intake silencer as a standard part which takes the form of a dry air filter, which works with a paper filter element.

On Model 220 Sb two different versions of the intake scoop have been installed (see Figs. 09-1/1 and 09-1/2). This change in scoop design was made in order to avoid the occasional occurrence of uneven build-up. At the same time it was necessary to enlarge the 1st stage main jets and the enriching jets of the carburetors (see also Job No 00-0). The 2nd version intake scoop can be installed subsequently provided that the 1st stage main jets of the carburetors are changed in accordance with the Table given in Job No. 00-0. It is not necessary in these cases to install a larger enrichment jet.

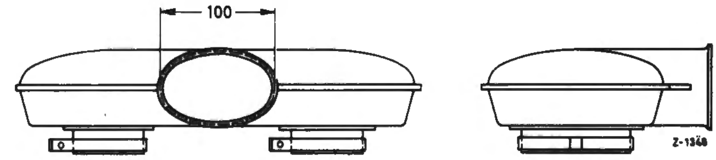


Fig. 09-1/1

Intake Scoop for Model 220 Sb
1st Version

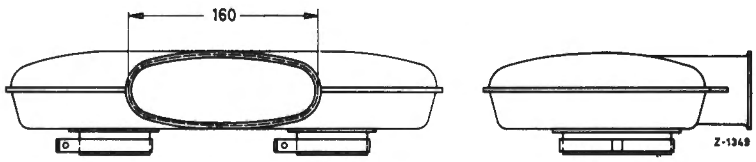


Fig. 09-1/2

Intake Scoop for Model 220 Sb
2nd Version

B. Removal and Installation

The following points require attention when the air intake silencer is removed and installed:

Models 220 b and 220 Sb

The retaining plate (11) for fixing the air intake silencer to the chassis base panel can be adjusted after loosening the hexagon screws (Fig. 09-1/4).

Models 220 SEb, 300 SE

When the air intake silencer is removed, the venturi control unit of the engine must be unscrewed. When the venturi control unit has been reinstalled it is necessary to check the adjustment of the control linkage (see Job No. 00-16).

C. Cleaning of Air Filter Element

I. Dry Air Filter

The air filter element should not be oiled or moistened.

Under normal road conditions (paved roads), the air filter element should be cleaned every 3000 km, and the filter element should be replaced after a mileage of 50 000 km.

If the car is driven on very dusty roads, the air filter element should be cleaned or replaced earlier, since a clogged air filter element reduces engine performance and increases fuel consumption.

The air filter element can be removed for cleaning or replacement without removing the air intake silencer.

1. On the air intake silencer upper part of Model 190 c detach the hose band on the carburetor (Fig. 09-1/3), on Models 220 b and 220 Sb remove the rubber cuff (3) (Fig. 09-1/4), and on Models 220 SEb and 300 SE pull off the air hose (6) (Fig. 09-1/5).

2. After loosening the snap catches, on Model 190 c after loosening the hexagon nut (5), remove the upper part of the air intake silencer and take out the air filter element.

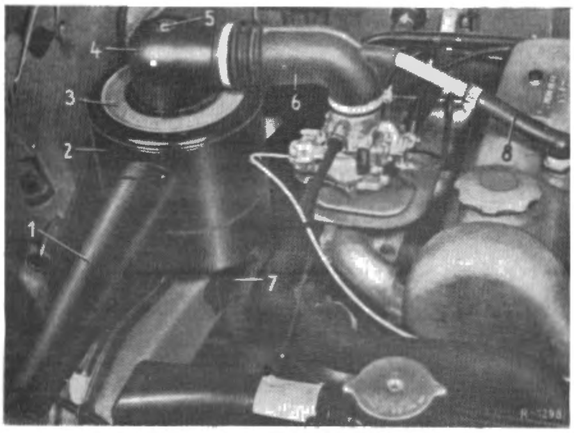


Fig. 09-1/3

Model 190 c

1 Air suction tube
2 Lower part of air intake silencer
3 Air filter element
4 Upper part of air intake silencer
5 Hexagon nut
6 Rubber bend
7 Retaining plate
8 Engine air-vent line

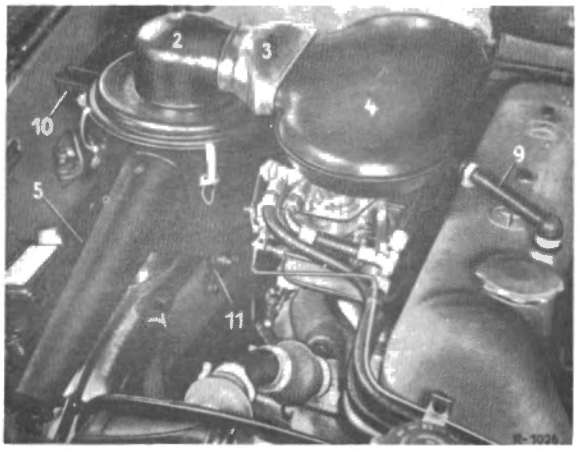


Fig. 09-1/4

Models 220 b and 220 Sb

1 Lower part of air intake silencer
2 Upper part of air intake silencer
3 Rubber cuff
4 Carburetor intake scoop
5 Air suction tube
6 Air hose
7 Venturi control unit
8 Position markings

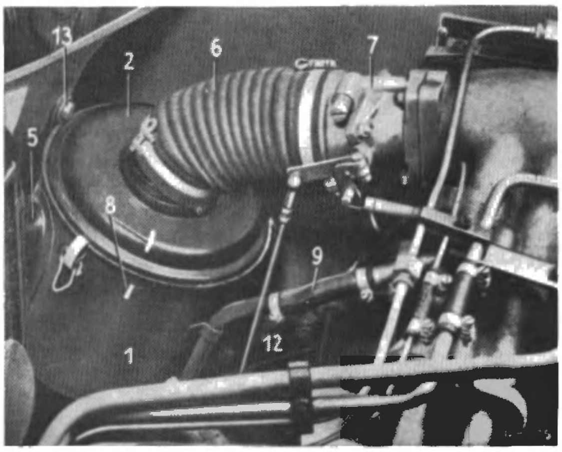


Fig. 09-1/5

Models 220 SEb and 300 SE

9 Connecting hose for engine air-vent line
10 Support bracket at wheel arch panel
11 Retaining plate for fixing the air intake silencer to the chassis base panel
12 Support bracket for fixing the air intake silencer to the wheel arch panel
13 Support bracket for fixing the air intake silencer to the cowl

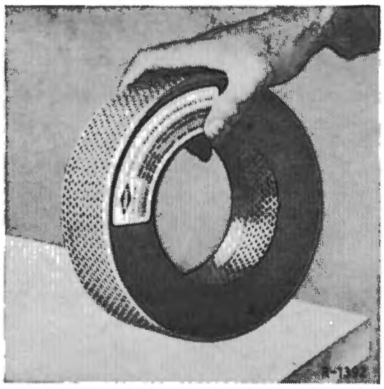


Fig. 09-1/6

Fig. 09-1/7

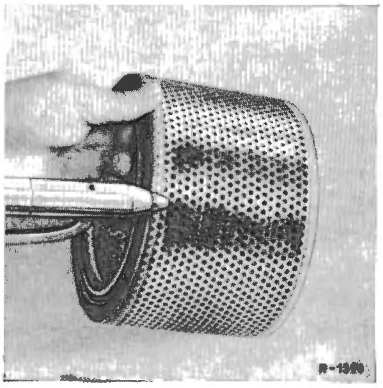


Fig. 09-1/8

3. Tap the air filter element carefully yet vigorously on a solid even surface (Fig. 09-1/6), then blow it out with compressed air (maximum pressure 5 atm) from the inside to the outside (Fig. 09-1/7), and then blow off the dirt on the outer cover of the element with the compressed-air gun held at an angle (Fig. 09-1/8).

Note: Dry air filter elements must under no circumstances be washed in a fluid or wetted with oil.

4. Clean the upper and lower parts of the air intake silencer from dust and condensation water. The best way is to use a gasoline-soaked rag.

Note: The air intake silencer must on no account be cleaned with cotton waste. When the air intake silencer is installed in the car any condensation water can best be removed through the bore in the lower part of the housing by means of a suitable syringe or a siphon.

5. Check and if necessary replace all rubber parts such as the sealing ring between the upper and lower parts of the air intake silencer, the rubber bend between the upper part and the Venturi control unit or the carburetor.

6. Install the air filter element. Install the upper part of the air intake silencer and fasten by simultaneously tightening two snap catches; on Model 190 c by tightening the hexagon nut (5). Care should be taken to ensure that the rubber sealing ring and the air outlet are properly positioned.

Note: On Model 220 SEb install the upper part in such a way that the two red line marks (8) are aligned (Fig. 09-1/5).

II. Oil Bath Air Filter

On this type of filter the inlet air flows into the fresh air chamber and through the inlet slot between element and housing to the oil bath chamber in which part of the dust is deposited. The remaining particles and the oil particles carried away by the air stream are deposited on

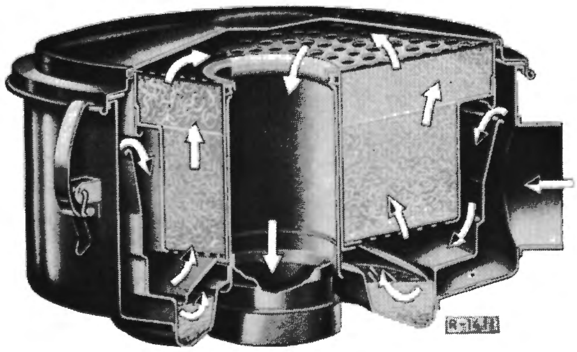


Fig. 09-1/9

the filter element which is wetted with oil by the air flow, and the surplus oil drips back into the oil bath (see Fig. 09-1/9).

The oil bath air filter can only work properly if in accordance with the prevailing amount of dust **it is cleaned in time** and **if it is supplied with fresh oil as specified.** "In time" means **as soon as the oil has become dark and viscous from the accumulated dirt.**

Wash the filter element thoroughly in Diesel fuel, kerosene or in an acid-free cleaning agent, centrifuge it, dry it or blow it out with compressed air.

Filters on which the filter element and the filter top form one integral part (Fig. 09-1/10), must be rinsed and blown out with compressed air from the top.

On no account must water or fluids containing alkali or acids be used for washing the element (the element will be destroyed for instance by P 3 or Tri).

Remove the old oil from the lower part of the filter completely and wash the part. The oil level in the oil bath chamber must be neither too **low** nor too **high; for that reason top up with fresh oil only to the mark "Normal-Ölstand" (Standard oil level)** (see arrow in Fig. 09-1/10). If the oil level is too low the filtering action is insufficient, and if the oil level is too high the air carries oil upward and through the filter element into the combustion chamber of the engine. Oil and dust form an abrasive compound which causes premature cylinder and piston wear.

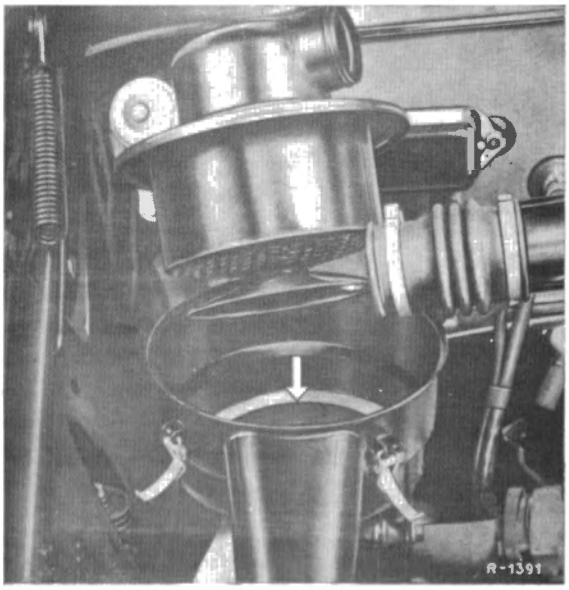


Fig. 09-1/10

The oil level must not be checked when the engine is warm but approximately one hour after switching off the engine. It is only then that the oil from the filter element has returned to the oil bath chamber. **Under normal circumstances the oil need not be topped up since the oil bath air filter does not lose oil if it is properly looked after.**

D. Inlet Air Pre-Heating an Models 220 b and 220 Sb

Recent cars of Models 220 b and 220 Sb have been equipped with an inlet air pre-heating system in order to prevent engine trouble resulting from speed build-up difficulties and icing of the jets of the carburetor.

On Model 190 c the inlet air pre-heating system can be installed as an optional extra.

The inlet air pre-heating system consists of a scoop (5) attached to the exhaust manifold; an air hose (4) connects the scoop to a pipe union with valve on the suction tube of the air intake silencer. The valve is controlled by a counterweight (3) on the valve shaft (2) and by the vacuum in the engine in such a way that at idling speed and in the partial load range the engine is supplied with warm air whereas in the full load range it is supplied with cold air (Fig. 09-1/11).

During the warmer season the inlet air pre-heating system must be switched off. To do this press the lever on the valve shaft (2) down and clamp it to the edge of the suction tube (Fig. 09-1/11).

If the inlet air pre-heating system is installed subsequently the lower part of the air intake silencer must be replaced, the scoop (5) must be screwed to the exhaust manifold and the scoop and the air intake silencer suction pipe must be connected by means of the air hose (4).

Fig. 09-1/11

Inlet air pre-heating system on Model 220 Sb

1 Lower part of air intake silencer
2 Valve shaft
3 Counterweight
4 Air hose
5 Scoop
6 W Winter position
S Summer position

Intake and Exhaust Manifold

Carefully examine the intake and exhaust manifold for cracks before re-installing them. In addition check the contact surfaces of the attaching flanges for displacement and distortion on a surface plate and, if necessary, recondition them. Cracked exhaust manifolds must always be replaced.

Replacement of the heating spiral, the damper spring and the heater valve and shaft is the same as in previous gasoline engines.

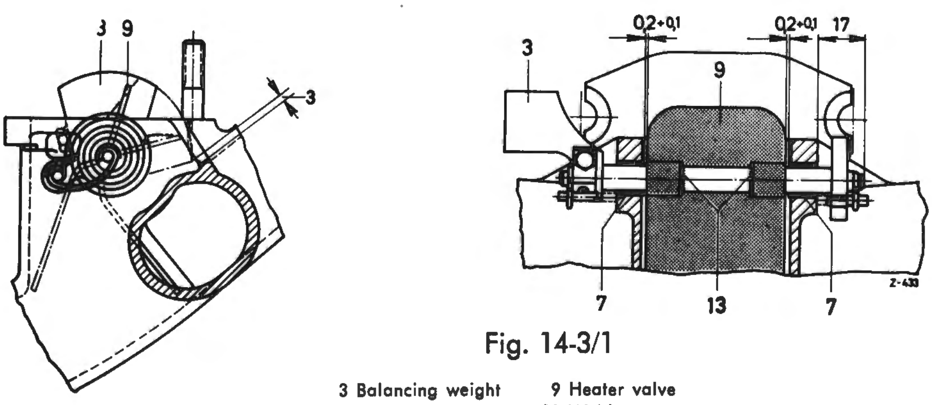


Fig. 14-3/1

3 Balancing weight
7 Bushing
9 Heater valve
13 Weld seam

Heater Valve Mounting

Dimensions in mm

Internal ⌀ of bushing	10.132 10.159
External ⌀ of bushing	13.039 13.028
Bore in exhaust manifold	13.000 13.018
Diameter of valve shaft	9.995 9.986

Engine Lubrication - Group 18

Engine Cooling Units - Group 20

Oil Filter

Job No.
18-1

Oil Filter with Paper Filter Element

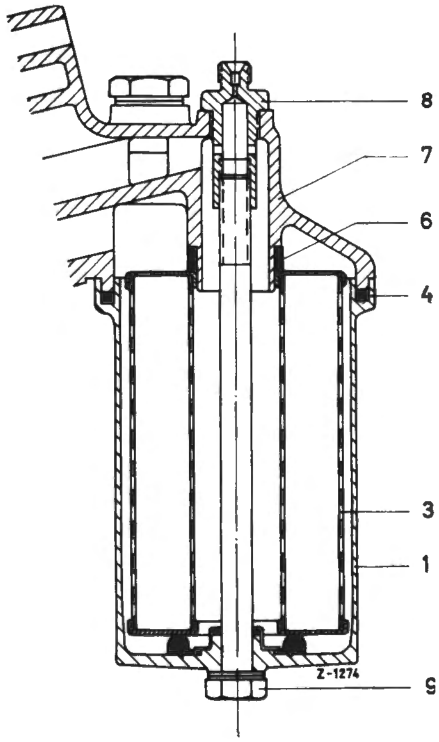


Fig. 18-1/1

1 Oil filter base
3 Paper filter element
4 Rubber sealing ring
6 Rubber sealing ring
7 Oil filter top
8 Threaded union
9 Hexagon fastening screw for the oil filter base

When the paper filter element (3) is being replaced the sealing ring in the oil filter base needs particular attention. **For reasons of safety always replace the sealing ring when the filter has been opened.** When inserting the sealing ring make sure that air pads do not form in the groove of the oil filter base below the sealing ring.

If an oil filter element shows unusual sludge formation, this is an indication that cooling water has mixed with the oil. Examine the engine and stop the leak.

Job No.
18-6

Drive for Oil Pump
Distributor and Injection Pump

Modification: 1st Paragraph amended

Models 190 c, 220 b, and 220 Sb

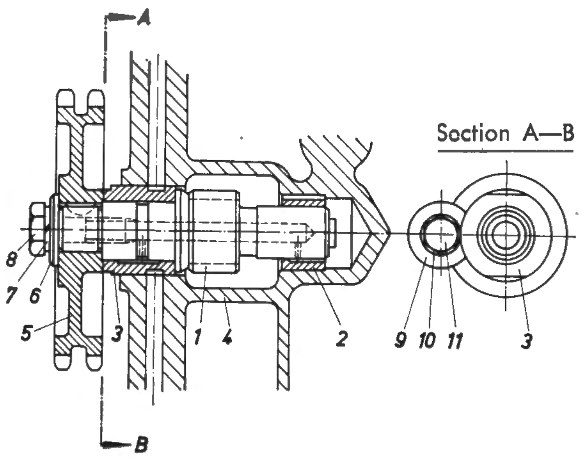


Fig. 18-6/1

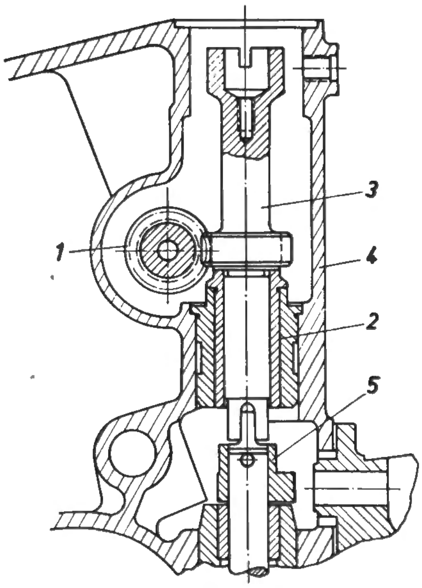


Fig. 18-6/2

Oil pump and distributor drive

1 Idling gear shaft with Woodruff key
2 Rear bearing bushing
3 Front bearing bushing
4 Crankcase
5 Idling gear
6 Washer
7 Lock washer
8 Hexagon screw
9 Retaining disk
10 Lock washer
11 Hexagon screw

1 Idling gear shaft
2 Bearing with bushing
3 Helical gear
4 Crankcase
5 Oil pump drive shaft with cam for fuel feed pump

Models 220 SEb and 230 SL

The engines for Models 220 SEb and 230 SL have an idling gear (24) with a shorter hub and a stop ring (42). On some cars of Model 220 SEb the stop ring was fastened to the idling gear (24) by means of the notched pin (41) (see Fig. 18-6/3).

Some engines for Model 220 SEb were not provided with a stop ring.

When repairs carried out, only the idling gear with the shorter hub and the additional stop ring (42) between idling gear and front bearing bushing should be installed.

If the idling gear has to be removed, first move the piston of the 1st cylinder to ignition TDC. Then remove the chain tensioner, the camshaft sprocket, the distributor (1), the distributor bearing (8) and the upper pivot pin for the chain guide bottom left. After loosening the hexagon nut (21), remove the lock washer (22), the washer (23), the drive sleeve (18), the front Woodruff key and the spacer sleeve (19). Now back out the locking screw for the chain drive several turns and remove the idling gear (24) and the stop ring (42) from the idling gear shaft (Fig. 18-6/3).

Note: Before dismantling the idling gear shaft on models where the stop ring is not fastened to the idling gear, stuff the chain case below the idling gear with a clean rag in order to prevent the stop ring form falling into the crankcase.

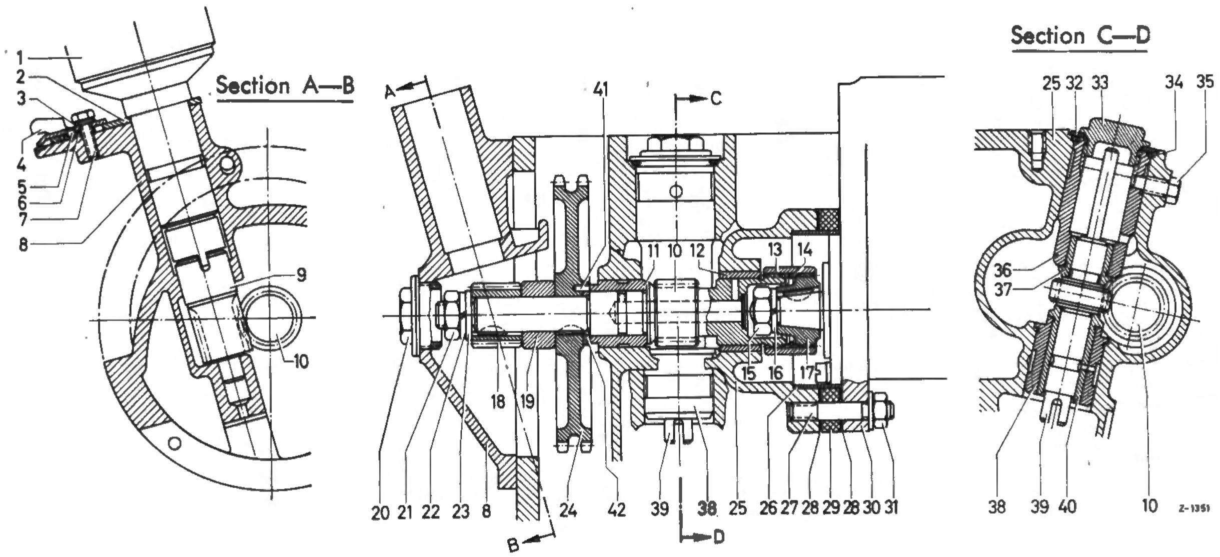


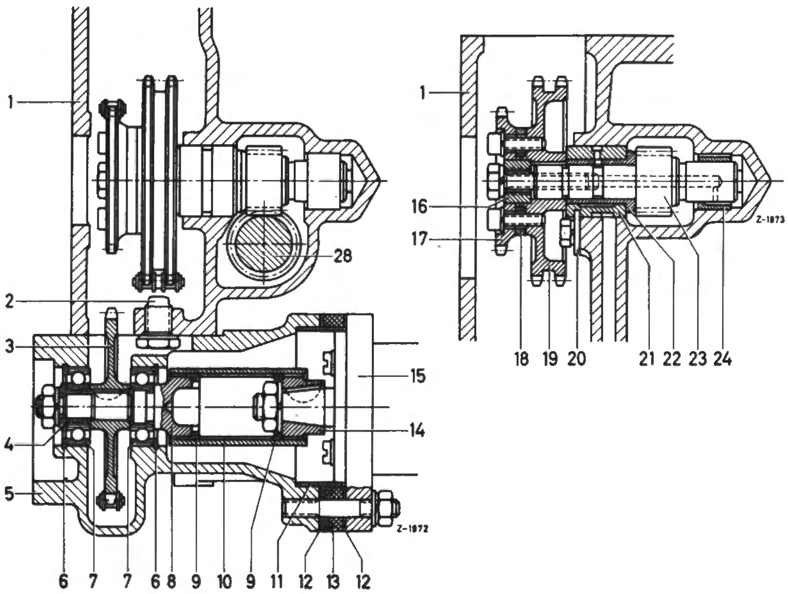
Fig. 18-6/3

Oil pump, distributor, and injection pump drive

1 Distributor	11 Bearing bushing front	21 Hexagon nut	32 Cover disk
2 Timing lever	12 Bearing bushing rear	22 Lock washer	33 Screw plug
3 Spring washer	13 Coupling sleeve	23 Washer	34 Rubber ring
4 Hand lever	14 Snap ring	24 Idling gear	35 Hexagon screw
5 Cylindrical pin	15 Hexagon nut	25 Crankcase	36 Pressure piece
6 Eccentric disk	16 Lock washer	26 Bearing bushing	37 Bearing bushing
7 Hexagon screw	17 Follower	27 Stud bolt	38 Bearing assembly
8 Distributor bearing	18 Drive sleeve	28 Sealing flange	39 Helical gear
9 Helical gear	19 Spacer sleeve		40 Bearing bushing
10 Idling gear shaft	20 Screw plug and seal	30 Injection pump	41 Notched pin
		31 Hexagon nut and washer	42 Stop ring

For revolution counter drive see Job No. 06

Model 300 SE



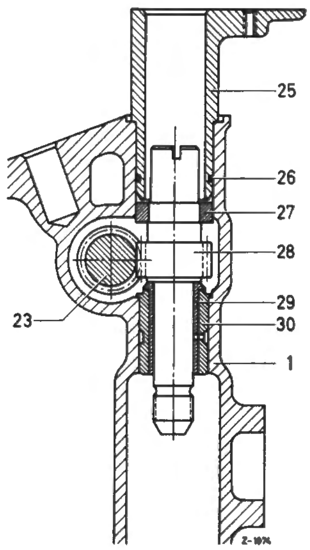


Fig. 18-6/4

Injection pump drive

Fig. 18-6/5

Oil pump and distributor drive

1 Crankcase
2 Locking screw for sprocket
3 Sprocket
4 Bushing
5 Gear housing
6 Snap ring
7 Grooved ball bearing
8 Drive shaft
9 Snap ring
10 Coupling sleeve for injection pump drive
11 Bearing sleeve
12 Sealing flange
13 Insulating flange
14 Follower
15 Injection pump
16 Centering roll
17 Sprocket
18 Shim
19 Idling gear
20 Washer
21 Bearing bushing (for idling gear front)
22 Bushing (on idling gear shaft)
23 Idling gear shaft
24 Bearing bushing (for idling gear, rear)
28 Oil pump and distributor drive shaft

1 Crankcase
23 Idling gear shaft
25 Distributor bearing
26 Sealing ring
27 Oil deflector ring (on drive shaft)
28 Oil pump and distributor drive shaft
29 Bearing bushing for drive shaft
30 Bearing assembly for drive shaft

On Model 300 SE the injection pump is driven by a single roller chain via sprockets (3) and (17), and the idling gear shaft (23) with idling gear (19) by a twin roller chain (Fig. 18-6/4).

For revolution counter drive see Job No. 06.

Removal and Installation of Water Pump

Job No.
20-1

Model 300 SE

Removal:

1. Drain the cooling water and collect the water if additives are present.

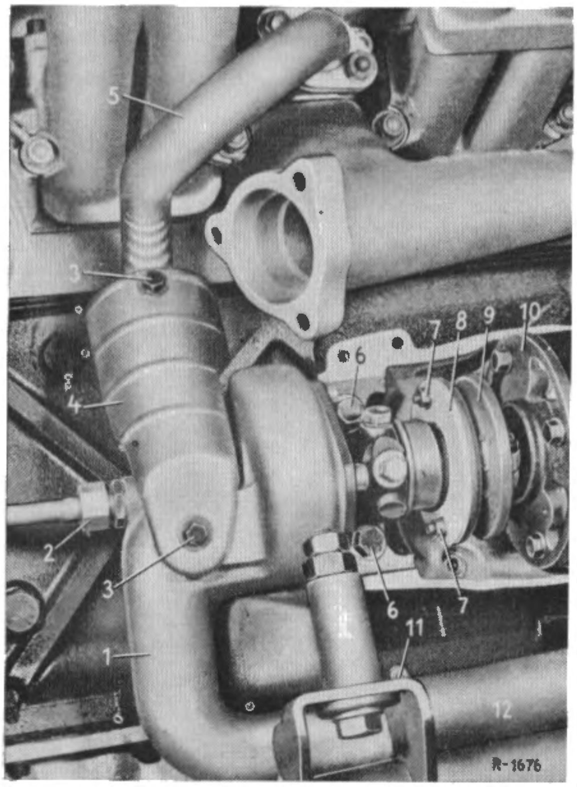


Fig. 20-1/1

1 Water pump
2 Cooling water line
3 Hexagon screw with cover plate
4 Cover plate
5 By-pass line
6 Hexagon screw on bearing housing
7 Hexagon nut with corrugated washer
8 Coupling flange water pump
9 Coupling flange generator
10 Generator
11 Hose strap
12 Rubber hose

2. Pull off the rubber hose (12) between water pump and radiator (Fig. 20-1/1).

3. Disconnect the cooling water line (2) to the injection pump thermostat at the water pump.

4. Remove the cover plate (4) and disconnect the by-pass line (5) from the water pump.

5. Detach the hose clip between water pump and crankcase and remove the clip and the two clip halves.

6. Unscrew the two hexagon nuts (7) on the water pump coupling flange (8).

7. Unscrew the two hexagon screws (6) fastening the bearing housing of the water pump to the generator bed and move the water pump out of the coupling flange of the generator.

8. Remove the rubber seal between water pump and crankcase and check whether it is still serviceable.

Note: Hardened or compressed rubber seals should always be replaced since they may cause leaks on reassembly.

Installation:

9. When the unit is being reassembled the seal between crankcase and water pump is fitted to the cone of the water pump.
The installation of the water pump is the reverse of the removal procedure.

Job No.
20-3

Removal and Installation of Fan Mounting Bracket

Removal:

1. Remove the radiator (see Job No. 50-1).

2. Loosen the three hexagon nuts (8) and (10) on the fan mounting bracket (9), loosen the lock nut on the tensioning screw (6), back out the tensioning screw and remove the V-belt.

3. Remove hexagon nuts (8) and (10) and remove the fan mounting bracket together with retaining plate (7).

Installation:

4. Attach the fan mounting bracket (9) and retaining plate (7) putting hexagon nuts (8) and (10) in position without tightening them.

5. Put on the V-belt and tension it by means of the tensioning screw (6). The V-belt is properly tensioned when it can be depressed under moderate thumb pressure approx. 5–10 mm.

6. Tighten the lock nut on the tensioning screw (6) and the hexagon nuts (8) and (10) on the fan mounting bracket.

7. Install the radiator (see Job No. 50-1).

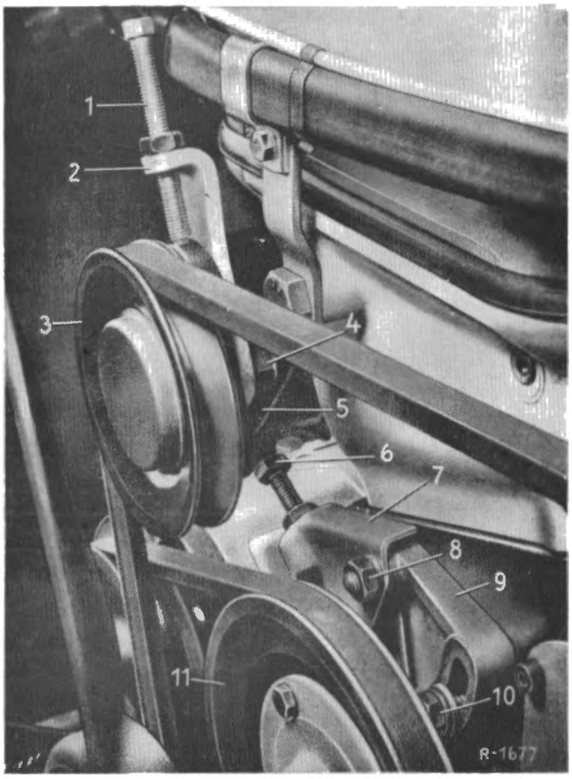


Fig. 20-3/1

1 Hexagon screw (tensioning screw)
2 Tension bracket
3 V-belt pulley
4 Hexagon nut with lock washer
5 Bracket
6 Hexagon screw (tensioning screw)
7 Retaining plate
8 Hexagon nut with lock washer
9 Fan mounting bracket
10 Hexagon nut with lock washer and washer
11 V-belt pulley

Repair of Fan Mounting Bracket

Job No.
20-5

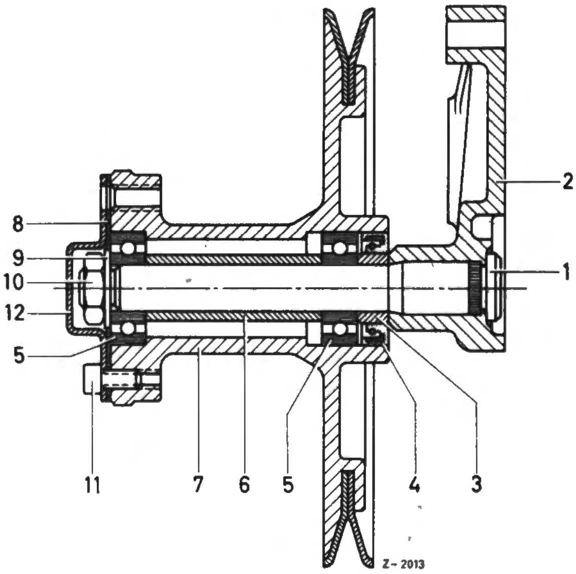


Fig. 20-5/1

1 Fan axle
2 Mounting bracket
3 Spacer ring
4 Seal
5 Annular grooved bearing
6 Spacer tube
7 Hub with pulley
8 Gasket
9 Spring washer
10 Hexagon nut
11 Hexagon socket screw
12 Cover cap

Disassembly

1. Unscrew the fan from the hub.

2. Unscrew the hexagon socket screws (11) from the hub and remove the cover cap (12) together with gasket (8).

3. Unscrew the hexagon nut (10) from the fan axle (1) and remove together with spring washer (9).

4. Drive the mounting bracket (2) together with the fan axle (1) out of the hub (7) toward the rear.

5. In the case of sand-cast pulleys unscrew the pulley from the hub. In the case of the die-cast version the pulley is cast integral with the hub.

6. Use a suitable drift to tap the annular grooved bearing (5) and the seal (4) out of the hub and remove the spacer tube (6) from the hub.

7. Clean all parts. Check the annular grooved bearings, the spacer ring (3), and the pulley for wear. Worn spacer rings should be pressed or turned off the fan axle.

   The seal (4) and the gasket (8) should always be replaced.

Reassembly:

8. Press the annular grooved bearing (5) and the seal (4) into the hub (7) with a suitable drift, making sure that the seal is absolutely flush with the front face of the hub.

9. If necessary, press a new spacer ring (3) onto the fan axle (1). Lightly grease the spacer ring on the contact surface of the seal.

10. Press the fan axle (1) together with the mounting bracket (2) into the hub (7). Put 24 cm^3 Hypoid Oil SAE 90 into the hub and slide the spacer tube (6) over the fan axle.

11. Press the front annular grooved bearing (5) into the hub.

12. Put on the spring washer (9), screw on the hexagon nut (10) and tighten.

13. Fit a new gasket (8); screw the cover cap (12) and fan to the hub. On the sand-cast version fit the pulley to the hub.

Job No.
20-6

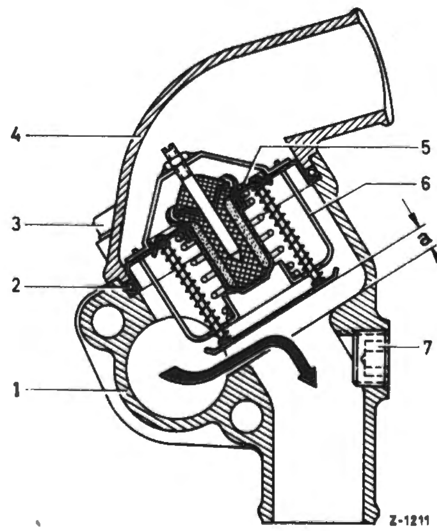
Cooling Water Thermostat

Modification: Model 300 SE and winter cooling water thermostat added

On Models 190 c, 220 b, 220 Sb and 220 SEb the cooling water thermostat consists of a cast light-metal housing which is screwed directly to the cylinder head with a gasket, and a thermostat element (6) (wax thermostat). On Model 300 SE the housing of the cooling water thermostat is combined with the cooling water outlet connection. The cooling water thermostat operates with a by-pass control. At cooling water temperatures below 78–79° C the cooling water from the cylinder head flows through the open by-pass valve and the by-pass line directly into the water pump (see Fig. 20-6/1). At a cooling water temperature of 78–79° C the wax thermostat element by opening the main valve starts to open the flow to the radiator and at the same time to close the by-pass line. When the main valve is fully opened, the cooling water flows from the cylinder head via the cooling water thermostat or through the open main valve to the radiator and only then to the water pump. At this stage the by-pass line is completely closed (see Fig. 20-6/2).

When reassembling the cooling water thermostat, care sould be taken to ensure that the four hexagon socket screws (3) are not tightened before the cover (4), and in particular the cover recess, is properly seated in the cooling water thermostat so that the sealing ring (2) is under uniform pressure.

Cooling Water Thermostat with Wax Thermostat Element and By-Pass Control



to water pump
via by-pass line

Fig. 20-6/1

Main valve closed — By-pass valve fully open
Stroke "a" = 6—6.5 mm from 0 to appr. 74—78° C

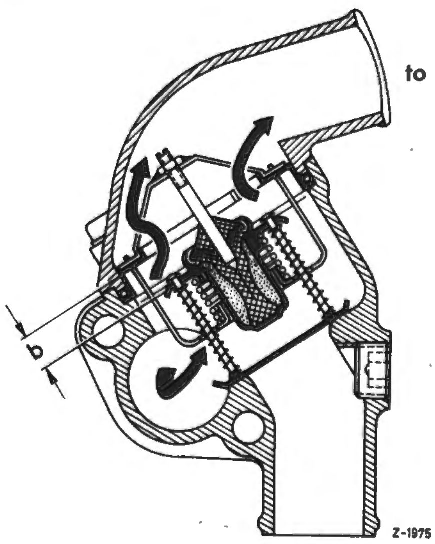


Fig. 20-6/2

Main valve open — By-pass valve closed
Stroke "b" = 8—9 mm at appr. 91—94° C

1 Cooling water thermostat
2 Sealing ring
3 Hexagon socket screw
4 Cover
5 Corrugation
6 Cooling water thermostat element
7 Plug

Note: To reach the optimum temperature more quickly in winter and thus to improve the performance of the heating system, a cooling water thermostat element can be installed which begins to open at a temperature of 87° C.

This winter thermostat can be obtained from our Replacement Part Division at Untertürkheim; it should be removed from the vehicle in spring to prevent overheating the engine during the summer.

Electromagnetic Fan Clutch on Model 300 SE

Job No.
20-10

Cars of Model 300 SE have been provided with an electromagnetic fan clutch as a standard part as from engine numbers

189 984-10-000 132	189 985-10-000 167
189 984-12-003 625	189 985-12-000 666

The clutch is controlled via a thermo switch which is located in the cooling water drain outlet. The fan clutch requires no maintenance.

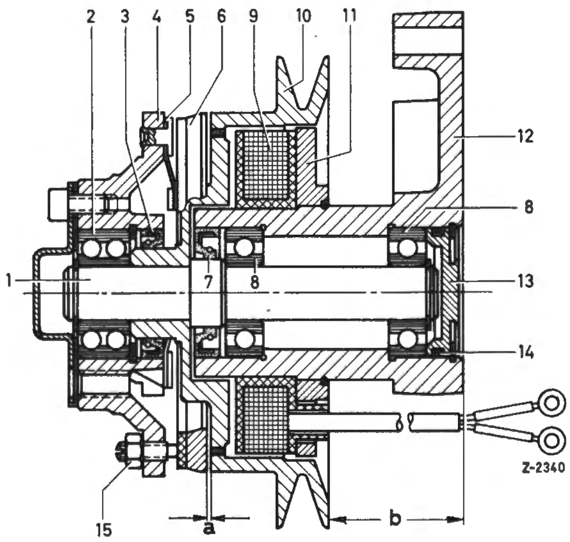


Fig. 20-10/1

Electromagnetic fan clutch

1 Fan shaft
2 Angular contact bearing
3 Radial sealing ring
4 Fan hub
5 Leaf spring
6 Clutch ring with insulating disk
7 Radial sealing ring
8 Grooved ball bearing
9 Coil frame with winding
10 Pulley
11 Magnetic disk
12 Fan bracket
13 Cover cap
14 O-ring
15 Adjustment screw with hexagon nut
a = Adjustment play 0.5—0.2 mm
b = Dimension from pulley to contact surface of fan bracket

A. General

The electromagnetic fan clutch has the special advantage that the fan requires no extra power while it is switched off. As a result the fan is only in operation in extreme cases, e. g. when driving in mountainous country or in a line of cars during the hot season, and engine output is increased. An additional advantage is that fan noises are reduced and that the engine warms up more readily

At a cooling water temperature of 92—96° C the circuit to the magnetic clutch coil is closed via the thermo switch. It may happen, however, that after fast driving followed by slow driving in a line of cars the engine heats more quickly and the thermo switch begins to operate with a certain delay. The cooling water temperature may rise to approx. 105° C without, however, damaging the motor in any way. Inductivity causes the clutch ring which is connected to the fan hub by the riveted leaf spring to be lifted and this operates the fan. When the cooling water temperature decreases to 87—83° C the thermo switch breaks contact and the fan rotates automatically, i. e. it is driven by the air stream.

B. Repair of Fan Clutch

Disassembly:

1. Unscrew the cover cap from the fan hub and remove together with the gasket. Drain the oil from the fan hub.
2. Remove the front retainer ring from the fan shaft (1). Pull the fan hub (4) together with the clutch ring (6) and the insulating disk off the fan shaft by means of Puller Part No. 000 589 17 33 (Fig. 20-10/1). Before pulling off the fan hub remove the pressure piece from the puller.

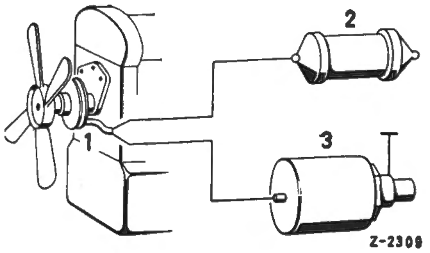


Fig. 20-10/2

Wiring diagram

1 Electromagnetic fan clutch
2 Fuse 3
3 Thermo switch

3. Remove the retainer ring from the fan bracket (12) and take out the cover cap (13). Drain the oil from the fan bracket.

4. Remove the rear retainer ring together with the shims from the fan shaft (1) and drive out the pulley together with the fan shaft from the fan brackets by means of a suitable drift.

   The pulley was shrunk on the fan shaft at a temperature of 300° C.

Note: On the previous version remove the retainer ring from the fan shaft (1), drive the fan shaft forward by approx. 30 mm and pull off the rear grooved ball bearing (8). Drive the fan shaft back and remove the center retaining ring from the fan shaft (1) and drive the pulley together with the fan shaft out of the fan bracket by means of a suitable drift.

5. Drive the radial sealing ring (7) and the front grooved ball bearing (8) out of the fan bracket (12).

6. Drive the angular contact bearing (2) out of the fan hub (4), remove the retainer ring and drive out the radial sealing ring (3). If the coil frame (9) should be defective, replace the fan bracket together with the magnetic disk and the coil frame. As a matter of principal always replace all bearings, the two radial sealing rings (3) and (7), the O-ring (14) in the cover cap (13) and the gasket on the cover cap.

Reassembly:

7. Reassembly is the reverse of the disassembly procedure (Fig. 20-10/1).

   Adjust the play "a" = $0.5_{-0.2}$ mm between the pulley and the clutch ring by means of the adjustment screw and the hexagon nut (15). When reassembling the fan clutch fill the bracket with 10 cc of oil and the fan hub with 5 cc of oil. Oil grade: ATF as for the automatic transmission.

Note: Before installing the rear retainer ring eliminate any axial play of the fan shaft by means of shims and then install the rear retainer ring.

On the previous version do not install the center retainer ring on the fan shaft (1) on the rear grooved ball bearing (8) and insert instead a shim 40—0.1×35×0.8 mm in the fan bracket before pressing in the front grooved ball bearing (8).

C. Trouble Shooting Hints

If complaints are received about premature vee-belt damage (wear) or if the vee-belt should jump off the pulley, check the alignment of the pulley on the fan clutch. The dimension "b" between the pulley and the contact surface of the fan bracket may be up to 43 mm and a dimension of 41.7 mm is still permissible. If the dimension is less than 41.7 mm replace the electromagnetic fan clutch.

If the temperature gage in the instrument cluster should register a temperature rise above 96° C, or in exceptional cases with thermo switch delays of over 105° C cooling water temperature, the cause may be either an insufficiently tensioned or a broken vee-belt. It is also possible that the thermo switch is defective. Check the thermo switch by running the engine up to a cooling water temperature of 100° C. At this temperature the thermo switch must have closed the circuit and the fan must rotate or if the engine is not working it should not be possible to turn the fan by hand. If with the engine stationary it is possible to turn the fan by hand the thermo switch must be replaced unless there is a failure in the electrical wiring. Check the function of the magnetic clutch at a cooling water temperature below 92° C by short-circuiting. The switching noise should be heard and if the fan clutch is in proper working condition, the fan should be rotating. Another cause may be excessive play "a" between clutch ring (6) and pulley (10) (see Fig. 6). The play should be $0.5_{-0.2}$ mm.

Job No.
22/24-0

Engine Suspension

General Data, Dimensions, and Tolerances

Modification: Tables supplemented

Front rubber mountings

Model	left		right	
	Part No.	Cast-in Part No.	Part No.	Cast-in Part No.
190 c 190 Dc	121 220 04 30 121 220 05 30 1)	121 223 04 12 180 223 10 12 1)	121 220 04 30 121 220 05 30 1)	121 223 04 12 180 223 10 12 1)
220 b 220 Sb 220 SEb	180 220 05 30 180 220 09 30 1)	180 223 09 12 180 223 11 12 1)	180 220 06 30 1) 180 220 10 30	180 223 10 12 1) 180 223 12 12
230 SL	127 220 03 30 127 220 04 30 1)	180 223 10 12 180 223 12 12 1)	127 220 03 30 127 220 04 30 1)	180 223 10 12 127 223 12 12 1)
300 SE	180 220 06 30	180 223 10 12	112 220 00 30	112 223 00 12

Rear rubber mountings

Model	Part No.	Cast-in Part No.
190 c	121 224 00 12 180 223 02 12 1) 120 223 04 12 2)3) 120 223 06 12 2)3)	121 224 00 12 180 223 02 12 1) 120 223 04 12 2)3) 120 223 06 12 2)3)
190 Dc	120 223 04 12 3) 120 223 06 12 3) 180 223 02 12 1)	120 223 04 12 3) 120 223 06 12 3) 180 223 02 12 1)
220 b, 220 Sb 220 SEb, 230 SL	120 223 04 12 3) 120 223 06 12 3)	120 223 04 12 3) 120 223 06 12 3)
300 SE	112 242 00 13	112 242 00 13

Adjustment of limit stop

	front		rear	
	dimension "a"		dimension "a"	
190 c, 190 Dc	14	fig. 22-1/1	10,5	fig. 24-1/2
220 b, 220 Sb 220 SEb Sedan and Coupé 300 SE Sedan and Coupé	1,5	fig. 22-1/2		
220 SEb Convertible 300 SE Convertible			33,5	fig. 24-1/3
230 SL	2 4)		21	fig. 24-1/4

1) Optional for bad road conditions
2) With automatic transmission
3) Optional
4) Under a load of 120 kg on the rubber mounting

Removal and Installation of Front Rubber Mounting of Engine Suspension

Job No.
22-1

Modification: Adjustment of Limit Stop on Model 230 SL added

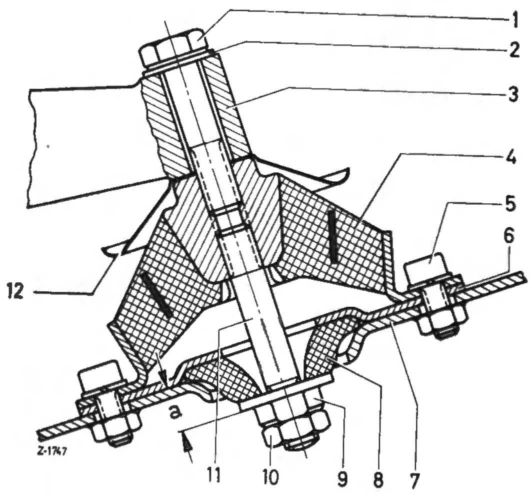


Fig. 22-1/1

Models 190 c, 190 Dc

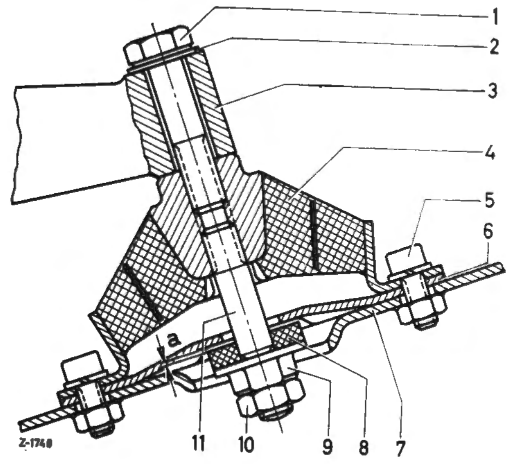


Fig. 22-1/2

Models 220 b, 220 Sb, 220 SEb, 300 SE

1 Hexagon screw
2 Spring washer
3 Engine support
4 Rubber mounting
5 Hexagon socket screw
6 Stop plate
7 Front axle support
8 Rubber spacer
9 Collar nut
10 Hexagon nut
11 Stud bolt
12 Cover disk

Removal:

1. Unscrew the hexagon screw (1) from the rubber mounting (4), holding the core in the rubber mounting steady with an SW 22 wrench.

2. Unscrew the two hexagon socket screws (5) by which the rubber mounting is fixed to the front axle support (7).

3. Use the jack to lift the engine till the weight is taken off the rubber mounting and it can be taken out.

   On Models 190 c and 190 Dc remove the cover disk (12) Fig. 22-1/1).

Note: Place a suitable pad between the jack and the oil pan.

4. Remove the limit stop from the rubber mounting after having unscrewed the hexagon nut (10) and the collar nut (9). Remove the rubber spacer (8) and the stop plate (6).

Note: The first version on Models 220 b, 220 Sb and 220 SEb had a castle nut and cotter pin instead of the hexagon nut and the collar nut.

Installation:

5. Install the limit stop in the rubber mounting.

Models 190 c, 190 Dc

Install the stop plate (6) and the rubber spacer (8). Screw on the collar nut (9) until the distance "a" is obtained. Measure the distance "a" with a depth gage between the collar nut (9) and the stop plate (6) (Fig. 22-1/1 and Job No. 22/24-0). Lock the collar nut (9) by means of the hexagon nut (10).

Models 200 b, 220 Sb, 220 SEb, 300 SE

Install the stop plate (6) and the rubber spacer (8). Adjust the distance "a" between the rubber spacer (8) and the stop plate (6) by means of the collar nut (9). To do this screw the collar nut down as far as it will go and back it out 1 turn (Fig. 22-1/2 and Job No. 22/24-0). Lock the collar nut (9) by means of the hexagon nut (10).

On the 1st version rubber mountings screw on the castle nut until the distance "a" is obtained and the nut can be locked by the cotter pin.

Model 230 SL

Intall the stop plate (6) and the rubber spacer (8). Screw the collar nut (9) down as far as it will go. Compress the rubber mountings in a press until there is a sufficient distance between the stop plate (6) and the rubber spacer (8). Then screw in the collar nut **two turns** and lock by means of the hexagon nut (10) (Fig. 22-1/2).

Note: This load on the rubber mounting is necessary in order to prevent torsional stress and damage to the rubber spacer when the collar nut is being turned.

6. Fasten the rubber mounting to the front axle support by means of the hexagon socket screws.

   On Models 190 c and 190 Dc remove the cover disk (12) (Fig. 22-1/1).

Note: On the six-cylinder engines, with the exception of Model 230 SL, the left and right rubber mountings are different.

7. Lower the engine and install and tighten the hexagon screw (1) with spring washer holding the core in the rubber mounting steady with an SW 22 open wrench.

Removal and Installation of Rear Rubber Mounting of Engine Suspension

Job No.
24-1

Modification: Adjustment of Limit Stop on Model 230 SL with Figure added

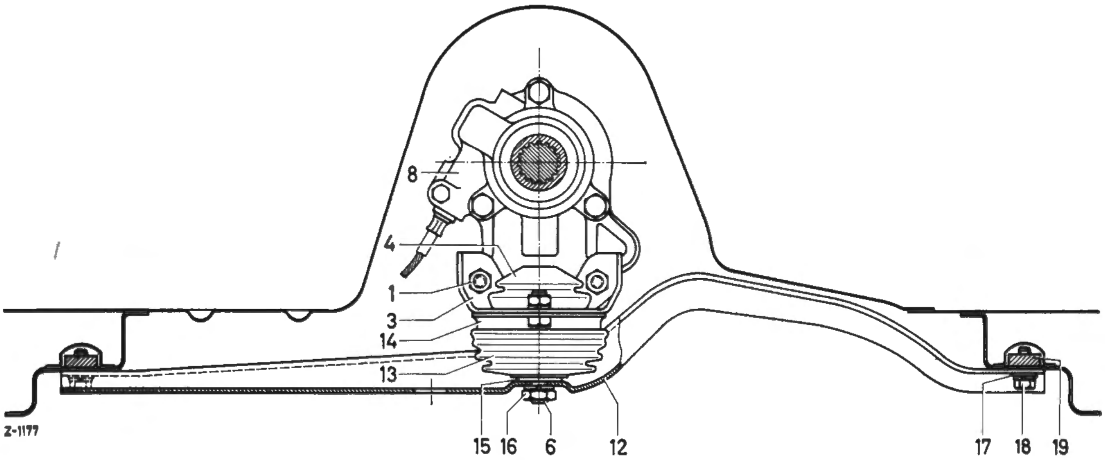


Fig. 24-1/1

1 Hexagon nut
3 Rear engine support
4 Bellows
6 Hexagon screw
8 Transmission case rear cover
12 Support
13 Bellows
14 Rubber mounting
15 Sheet-metal cover
16 Hexagon nut
17 Washer
18 Hexagon screw
19 Nut

Removal:

1. Unscrew the hexagon nut (16) or (19) (Fig. 24-1/2 or /3, /4).

2. Lift the engine at the rear part of the oil pan until the rubber mounting (14) is free from tension.

Note: To prevent the oil pan from being damaged, a suitable piece of wood must be placed between the oil pan and the jack.

3. Mark the position of the support in relation to the chassis base panel (Fig. 26-1/4).

4. Detach the center brake cable at the brake lever, and remove from the cable guide of the front axle support and the support.

5. Unscrew the support (12) from the chassis base panel (Figs. 24-1/1 or /3, /4).

6. Remove the sheet-metal cover (15) and the bellows (13) from the rubber mounting (14). Then remove the bellows (4) and unscrew the hexagon lock nut (6) (Figs. 24-1/2 or 24-1/3, /4). On Models 220 SEb and 300 SE Convertible and Model 230 SL unscrew first the hexagon nut (16) or (20).

7. Screw off the rubber mounting from the engine support.

Installation:

8. Attach the rubber mounting (14) to the engine support (3), and put on the bellows (13) and the sheet-metal cover (15) (Figs. 24-1/2 and 24-1/3, /4).

On Models 220 SEb and 300 SE Convertible and Model 230 SL adjust the limit stop. To do this screw in the hexagon screw (6) until dimension "a" is reached (Fig. 24-1/3 or /4 and Job No. 22/24-0). Then lock the screw (6) with the lock nut (16 or 20). Put on the bellows (4) and push on the spacer ring (17).

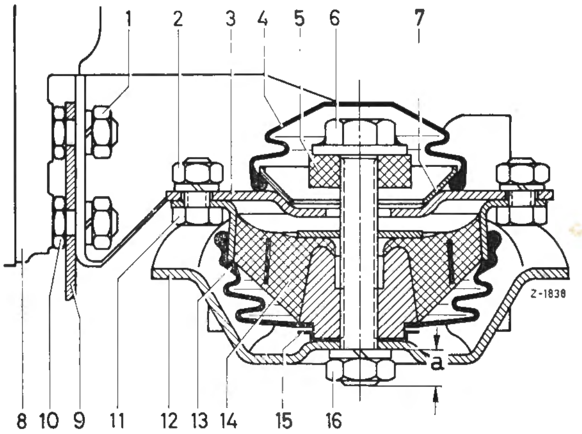


Fig. 24-1/2

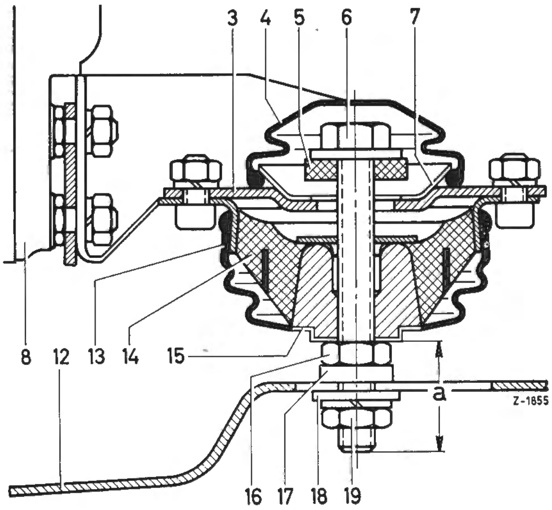


Fig. 24-1/3

Models 220 SEb Convertible, 300 SE Convertible

1 Hexagon nut
2 Hexagon nut
3 Engine support
4 Bellows
5 Rubber spacer
6 Hexagon screw
7 Bracket for bellows
8 Transmission case rear cover
9 Attachment plate
10 Collar screw
11 Hexagon screw
12 Support
13 Bellows
14 Rubber mounting
15 Sheet-metal cover
16 Hexagon nut
17 Spacer ring
18 Washer
19 Hexagon nut

9. Fasten the support (12) to the chassis base panel, noting carefully the position marked on the chassis base panel and on the engine support.

10. Lower the engine. On Models 220 SEb and 300 SE Convertible and on Model 230 SL install the washer (18) and the lock washer, then tighten the hexagon nut (19) (Fig. 24-1/3 or 24-1/4).

11. In order to adjust the limit stop on Sedans and Coupés properly screw in the hexagon screw (6) until the distance "a" is obtained. Measure the distance "a" with a depth gage between the hexagon screw (6) and the support (12) (Fig. 24-1/2 and Job No. 22/24-0). Then install the spring washer and screw on the hexagon nut (16). When tightening the hexagon nut make sure that the hexagon screw (6) does not turn. When the limit stop is adjusted correctly, the beveled edge of the hexagon screw (6) projects beyond the hexagon nut (16) appr. 1 mm (Fig. 24-1/2).

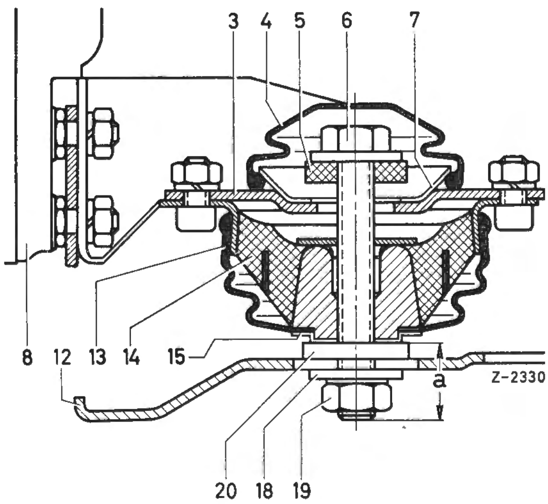


Fig. 24-1/4

Model 230 SL

12. Install the bellows (4) on the rear engine suspension (Fig. 24-1/2).

13. Attach the hand brake cable to the brake lever.

14. Adjust the hand brake.

Clutch Group 25

Clutch

General Data, Dimensions and Tolerances

Modification: Revised and New Models Added

A. Mechanical Clutch

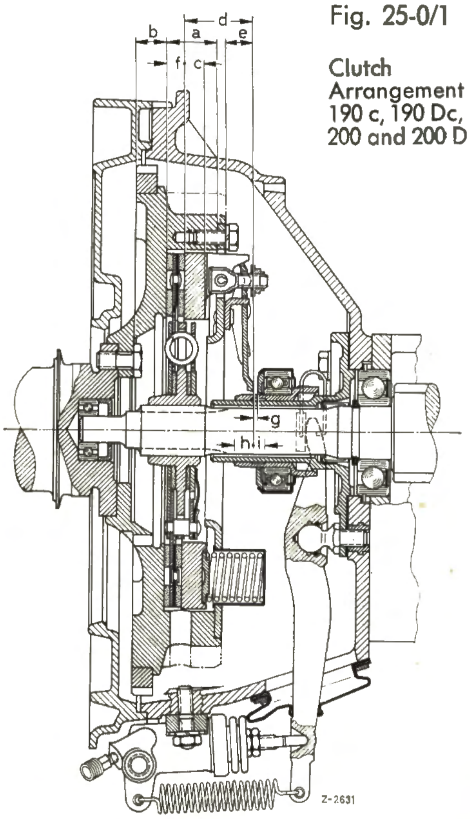


Fig. 25-0/1

Clutch Arrangement 190 c, 190 Dc, 200 and 200 D

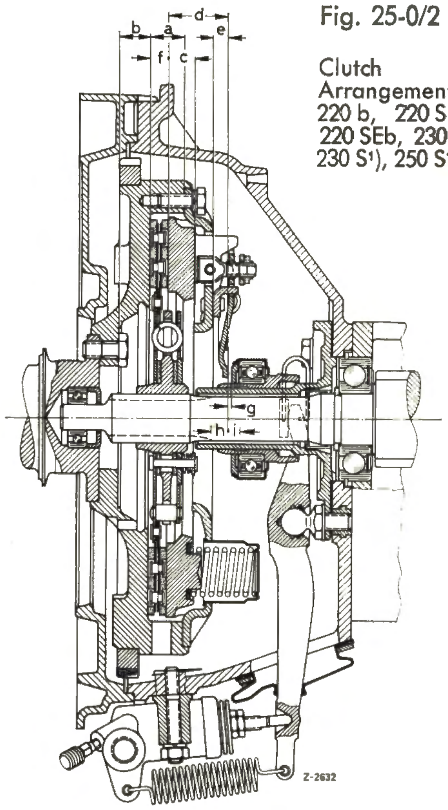


Fig. 25-0/2

Clutch Arrangement 220 b, 220 Sb, 220 SEb, 230 SL[1]), 230[1]), 230 S[1]), 250 S[1]) and 250 SE[1])

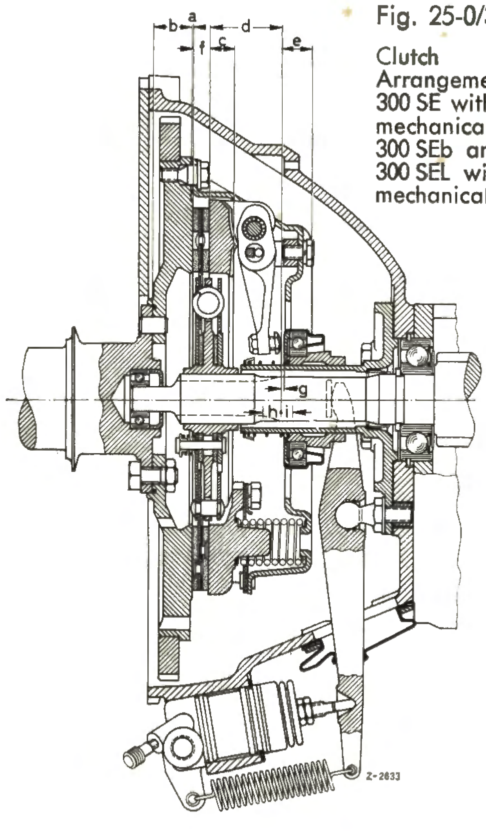


Fig. 25-0/3

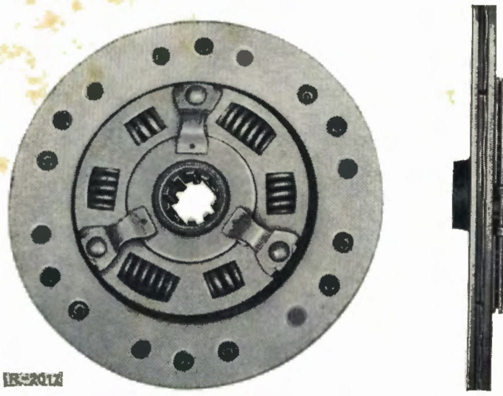
Clutch Arrangement 300 SE with mechanical transmission 300 SEb and 300 SEL with mechanical transmission

Legends of Figs. 25-0/1 to 0/3

a = Clearance between clutch face and clutch clamping face on the flywheel (see also Fig. 25-1/2)
b = Clearance between clutch face and flywheel attaching flange (see also Fig. 25-1/2)
c = Thickness of clutch pressure plate
d = Adjusting dimension for clutch assembly
e = Control dimension between cover plate and release levers for new driven plate
f = Thickness of new driven plate compressed
g = Free play between throw-out bearing and release levers (clutch free play)
h = Throw-out travel
i = Travel of release levers because of driven plate wear

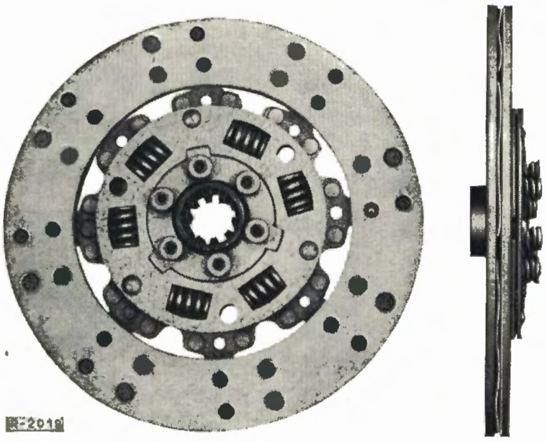
[1]) The clutches of these models are provided with a sheet-metal ring over the spring cups for better engine speed adaptability.

Driven Plate



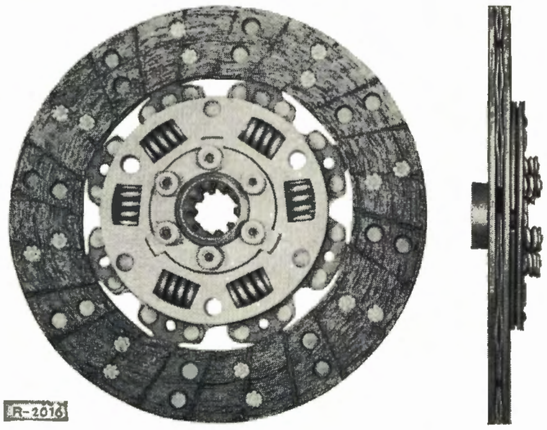
Models 190 c, 190 Dc, 200 and 200 D

Pressure Plate



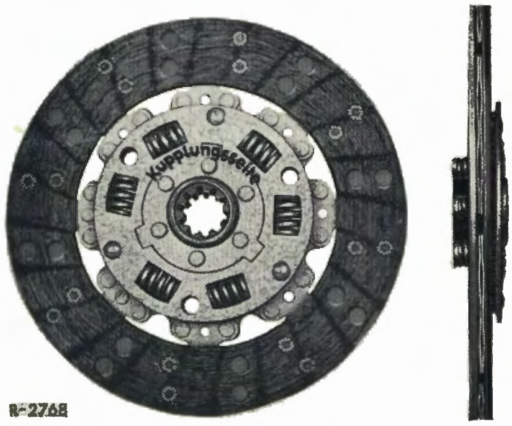
Models 220 b, 220 Sb and 220 SEb

with single spring-loaded facing



Models 220 b, 220 Sb, 220 SEb and 230 SL

with double spring-loaded facing



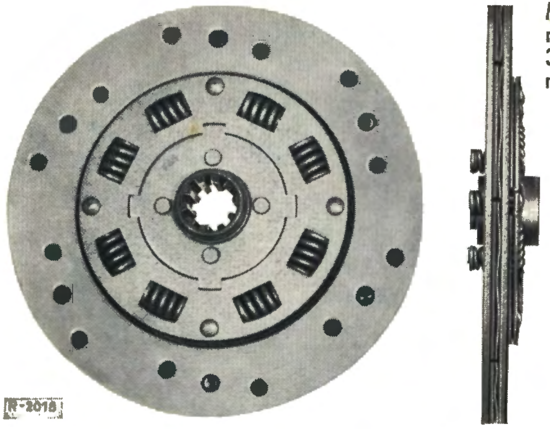
Models 230, 230 S, 250 S, 250 SE and 230 SL

with double spring-loaded facing

R-2660

1 Sheet-metal ring for better engine speed adaptability

Driven Plate



Pressure Plate

Models 300 SE with mechanical transmission, 300 SEb and 300 SEL with mechanical transmission

Clutch Pressure Plate

Model	190 c, 190 Dc 200, 200 D	220 b, 220 Sb, 220 SEb Sedan	220 SEb/C	230 230 S 230 SL 250 S 250 SE	300 SE[6]) 300 SEb 300 SEL[6])
Fichtel & Sachs Designation	KS 200 KV[3])	TK 228 KX[4])			HB 18 Sph
Part No.	180 250 07 04	000 250 27 04[4])	000 250 29 04	000 250 68 04[5])	189 250 01 04
Control dimension "e" between cover plate and the release levers with new driven plate installed mm	17.5 ± 0.2	7.0 ± 0.2			18 ± 0.2
Resulting adjusting dimension of worn-out driven plate mm	24.5	14			11
Adjusting dimension "d" for clutch assembly mm	41.4	36.8			42.5
Travel "i" of release levers because of permissible wear of driven plate mm	7				
Throw-out travel "h" of release levers mm max.	10				10.6
Free play "g" between throw-out bearing and release levers (clutch free play) mm	2				
Maximum permissible difference between the release levers[1]) mm	0.3				
Thickness "c" of pressure plate (Fig. 25-0/1) mm	15	16.5			14.5
Regrind dimension of the pressure plate[2]) mm max.	1				
Maximum permissible unbalance of the pressure plate cmg	20	15			
Contact pressure kg	475	540 ± 25			620
Clutch springs					
Number	9				
Part No.	000 252 16 20	000 252 18 20			000 252 23 20
Color code	colorless and gold	yellow and gold			light blue and gold
External diameter mm	29	28.6			27.4
Wire gage	4	4.1			4.2
Free length mm	50	55.1			58.5
Length under load mm	32.4	37.2			39.5
Load kg	53 + 6	61.5 ± 2.5			69 ± 3.5

[1]) Press down the release levers several times before measuring.
[2]) If the reduction in thickness exceeds 0.5 mm, ground shims corresponding in thickness to the total amount of material removed should be placed between the clutch springs and the cups to restore the total spring presssure.
[3]) New Fichtel & Sachs designation, previously KS 12 KV.
[4]) 2nd version. On the 1st version the Fichtel & Sachs designation was TK 228 KV and the Part No. 128 250 02 04.
[5]) On Model 230 SL — 2nd version; 1st version was 000 250 29 04.
[6]) With mechanical transmission.

25-0/1c

Driven Plate

Model		190 c, 190 Dc, 200, 200 D	220 b, 220 Sb, 220 SEb	230, 230 S, 230 SL, 250 S, 250 SE	300 SE[5]) 300 SEb 300 SEL[5])
Fichtel & Sachs designation		200 SZP	228 SD[2])		225 SZ
Part No.		000 250 45 03[1])	000 250 87 03[3])	001 250 11 03[4])	000 250 77 03[6])
Thickness of the driven plate "f"	released mm	10.3 + 0.3	10.3 + 0.4		10.6 + 0.4
	compressed mm	9.1 + 0.3	$9.1^{+0.4}_{-0.1}$		$9.3^{+0.4}_{-0.1}$
Thickness of facing	mm	3.5	3.8		3.5
Permissible wear of facing thickness on either side	mm	1			
Permissible unbalance	cmg	5			
Permissible run-out	mm	0.5[7])			
Permissible radial play on the drive shaft	mm	0.04 ± 0.01			
Torsion damper: Free motion torque, traction side	mkg	17.3	20		30
Torsion damper: Stop angle	degrees	8°30'	5°		4°
Torsion damper: Friction torque	mkg	0.6 — 0.9	1.4 — 1.7		0.9 — 1.2

Throw-Out Bearing

Model		190 c to 230 SL	300 SE[9])
Internal diameter of the throw-out bearing	mm	39.988 / 40.000	49.988 / 50.000
External diameter of the throw-out bearing	mm	40.006 / 39.995	50.006 / 49.995
Oversize (+) or play (—) of the throw-out bearing on the throw-out unit	mm	— 0.005 to + 0.018	
Internal diameter of the throw-out unit	mm	35.600 / 35.639	40.100 / 40.139
External diameter of the transmission case front cover	mm	35.500 / 35.438	40.000 / 39.938
Clearance between throw-out unit and neck at transmission case front cover	mm	0.1 — 0.2	

[1]) 2nd version, 1st version was 000 250 41 03.
[2]) On 220 models 3rd version, 2nd version was 228 SBL, 1st version was K 16 CBL.
[3]) On 220 models 5th version, 4th version was 000 250 72 03, 3rd version was 000 250 55 03, 2nd version was 000 250 43 03, 1st version was 128 250 00 03.
[4]) On model 230 SL 3rd version, 2nd version was 000 250 87 03, 1st version was 000 250 72 03.
[5]) With mechanical transmission.
[6]) 2nd version, 1st version was 000 250 65 03.
[7]) For handling of driven plate see Job No. 25-1.
[8]) The throw-out unit must be hypercooled before the throw-out bearing is pressed on.
[9]) With mechanical transmission.

Removal and Installation of Mechanical Clutch

Job No.
25-1

Modification: Revised and New Models Added

Removal:

1. Remove the transmission case (see Job No. 26-1).

2. Place the hold-down clamps 111 589 06 61 – or 186 589 01 61 for the 300 SE models with mechanical transmission – under the clutch release levers (Fig. 25-1/1).

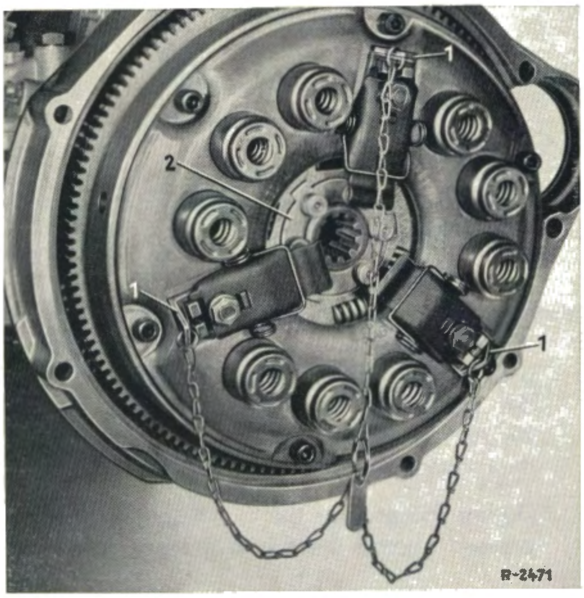


Fig. 25-1/1

1 Hold-down clamps
2 Driven plate

Note: If the clutch pressure plate is not to be disassembled, the hold-down clamps remain in position until the clutch is reinstalled. New and replacement clutches are supplied under tension by wire clamps.

3. Loosen the clutch fixing screws (hexagon socket screws) crosswise and evenly. Then remove the clutch together with the driven plate.

Caution: All **driven plates,** whether new or removed from the clutch must be **stored** and **handled** with the **greatest care** in order to prevent distortion of the facing rim.

Checking:

4. Check the clutch face of the flywheel and the clutch pressure plate for heat cracks and scores. If necessary, regrind or re-turn.

Note: When the friction surface "A" of the flywheel is reconditioned always refinish the surface "B" in order to reestablish the distance "a" and to maintain the prescribed contact pressure. The friction surface of the flywheel can be reconditioned until the lower limit of the dimension "b" is reached (Fig. 25-1/2). For dimensions see Job No. 03-0.

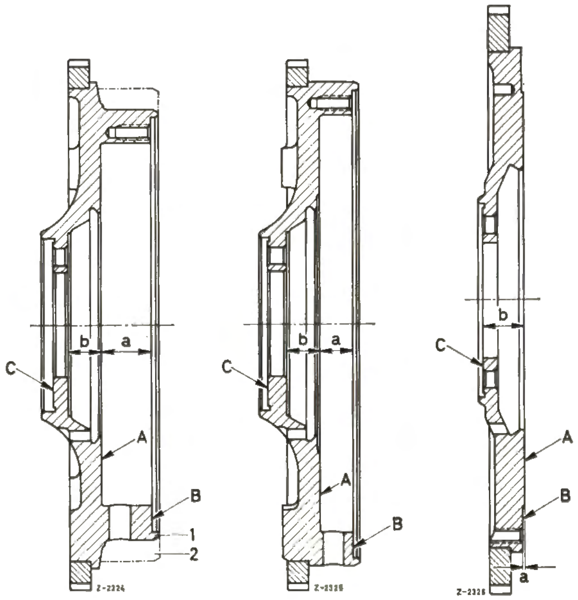


Fig. 25-1/2

1 = 190 c, 200 2 = 190 Dc, 200 D	220 b, 220 Sb, 220 SEb 230 SL 230, 230 S, 250 S, 250 SE	300 SE with mechanical transmission 300 SEb 300 SEL with mechanical transmission

5. Check whether the driven plate slides freely on the drive shaft.

Note: Carefully remove any rust or resinous deposits from the splineways of the drive shaft and from the hub of the driven plate. After cleaning the splineways should be given a **thin** coat of a suitable lubricant, e. g. Kenlube M-621.

6. Check the radial play of the driven plate on the drive shaft. For dimensions see Page 25-0/4.

7. Always check the driven plate for run-out and if necessary readjust it (Fig. 25-1/3). For maximum permissible run-out see Job No. 25-0.

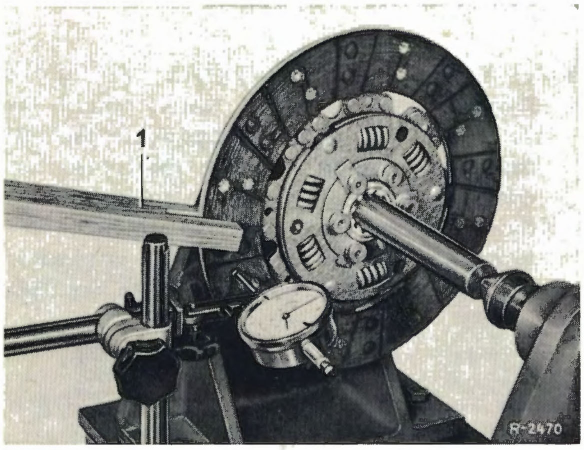


Fig. 25-1/3

1 Turning fork (wooden)

8. Check the annular grooved bearing between transmission drive shaft and crankshaft for ease of movement and lightly grease it.

Installation:

9. Center the driven plate (2) in the annular grooved bearing with Centering Arbor 136 589 00 61 (1) (Fig. 25-1/7).

Caution: The driven plate should be installed in such a way that the six small pressure springs of the friction damping system (three leaf springs on the 4-cylinder models) point **toward the rear,** i. e. **toward the transmission.** The arrangement is different on the 300 SE models with mechanical transmission: the four pressure springs of the friction damping system must point **toward the flywheel.**

On the **new driven plate** Part No. 001 250 11 03 for Models 230, 230 S, 230 SL, 250 S, and 250 SE the **friction damping springs** are also arranged **on the flywheel side** (Fig. 25-1/4). To ensure correct installation, the new driven plate is stamped "Kupplungsseite" on the side facing the clutch (see Page 25-0/1b).

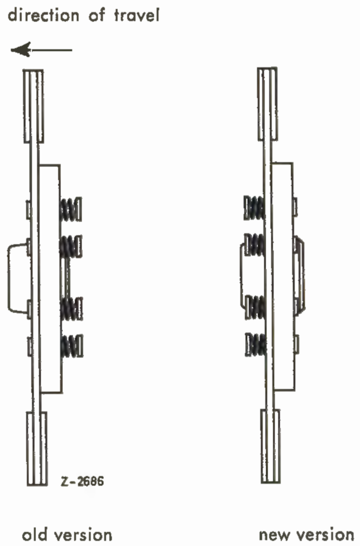


Fig. 25-1/4

10. Fit the clutch pressure plate and screw it down (Fig. 25-1/7).

Note: In order to prevent any clutch squeaking it is advisable to apply a **thin** brush coat of a suitable lubricant, e. g. Kenlube M-621, to the parts marked with an arrow in Fig. 25-1/5, in particular to the guide lugs (1) and their openings in the cover plate.

During this process the clutch should be compressed several times in a press.

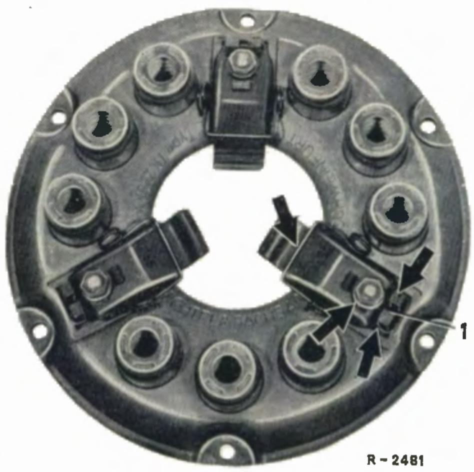


Fig. 25-1/5

1 Guide lug

Important: The clutch must not be forced into place; it must fit properly into the flywheel recess and must make even contact allround. The fixing screws should therefore be tightened crosswise and evenly.
On Model 300 SE two of the six fixing screws are fitted screws. Care must be taken to ensure that the fitted screws are inserted in the two larger holes of the clutch (see arrows in Fig. 25-1/6) and that these bores are aligned with the center bores in the flywheel when the clutch is being installed.

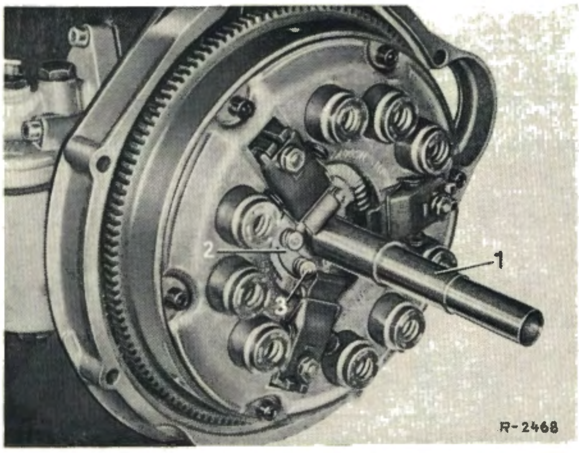


Fig. 25-1/7

1 Centering arbor
2 Driven plate
3 Pressure spring of friction damping system

11. After installation remove the centering arbor and the hold-down clamps.

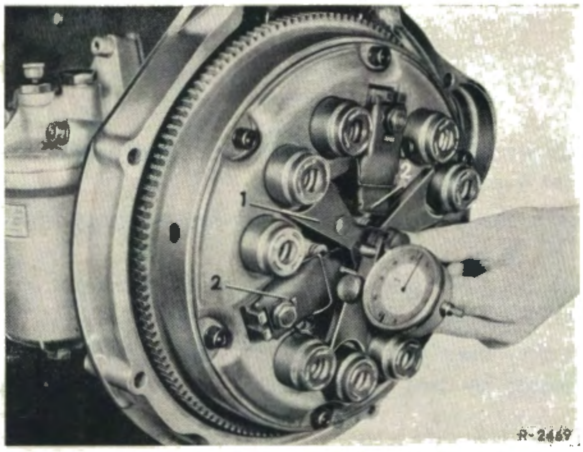


Fig. 25-1/8

1 Checking gage 110 589 01 21 00 with dial gage
2 Release lever

Fig. 25-1/6

12. Use Checking Gage 110 589 01 21 00 or a depth gage to check the adjusting dimension between release lever and cover plate (Fig. 25–1/8).
For dimensions see Job No. 25–0/3.

Note: The adjusting dimension can only be measured with the pressure plate installed i. e. pretensioned. Depress the release levers (3) several times before measuring. It is important that the distance from the cover plate should be identical for all three release levers (for dimensions see Job No. 25-0). Any excessive deviation between the release levers will produce a grabbing tendency of the clutch and the uneven pressure of the throw-out bearing will produce clutch noise and the bearing will become unserviceable.

13. Install the transmission (see Job No. 26–1).

14. Adjust clutch free play (see Job No. 29–6).

Performance Test:

With the engine running shift into reverse and check clutch performance and driven plate arresting period.

It must be borne in mind that at idling speed and with the transmission oil at operating temperature a fully serviceable driven plate needs 3 to 5 seconds after declutching before it comes to rest. It follows that grating noises will be produced if the reverse gear is engaged too fast.

Job No.
25-4

Clutch Throw-Out Bearing

In February 1964, the previous clutch throw-out bearings were replaced by a new design. The change was made as follows:

On Model	190 c	as from chassis end no.	081 441
	190 Dc		128 634
	220 b		056 243
	220 Sb		122 526
	220 SEb Sedan		058 618
	220 SEb/c		058 599
	230 SL		002 500

All new models whose production started in August 1965, have been provided with the new clutch throw-out bearings.

Cars of Model 300 SE with mechanical transmission (before August 1965) were not equipped with the new throw-out bearing but can subsequently (e. g. when repairs are necessary) be provided with the complete unit as installed in Models 300 SEb or 300 SEL with mechanical transmission.

Figures 25-4/1 and 4/2 show respectively the previous and the present version of the throw-out bearings and throw-out units.

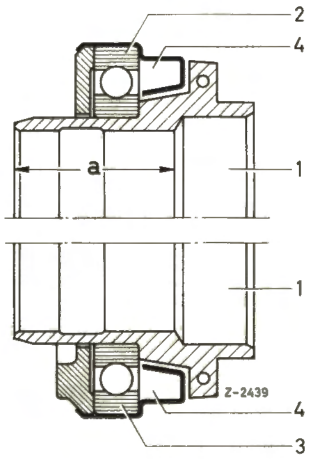


Fig. 25-4/1

Previous version

1 Throw-out unit
2 Throw-out bearing four-cylinder models
3 Throw-out bearing six-cylinder models
4 Circular chamber for grease cake
a = Supporting length of guide sleeve = 31.5 mm

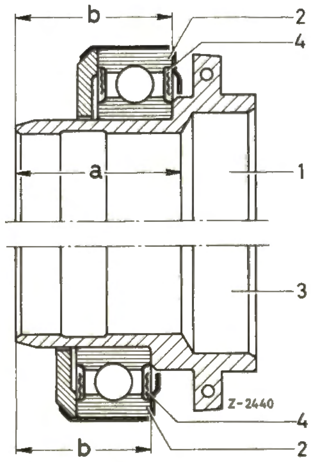


Fig. 25-4/2

Present version

1 Throw-out unit four-cylinder models
2 Throw-out bearing
3 Throw-out unit six-cylinder models
4 Positive seal
a = Supporting length of guide sleeve = 33.5 mm
b = Length of bearing sleeve
for four-cylinder models = 31.5 mm
for six-cylinder models = 27 mm

In the case of the "previous" version the throw-out unit was the same for the four-cylinder and six-cylinder models but the throw-out bearings were different (Fig. 25-4/1).

In the case of the "present" version there is a difference in the throw-out units and the throw-out bearings are the same (Fig. 25-4/2).

In order to improve axial guidance the inside length of the guide sleeve of the present throw-out unit was increased by 2 mm (compare dimension "a" in Figs. 25-4/1 and 2).

The "previous" bearings were lubricated by a grease cake; the "present-version" bearings are filled with silicone grease and are protected against grease losses by two positive seals, whose function is particularly important when the bearings are hot.

Caution: Neither bearing version requires any maintenance and should under no circumstances be washed out.

Wherever a transmission is to be cleaned with solvents, the throw-out bearings must be removed beforehand.

Replacing the Throw-Out Bearing

Removal:

1. Remove the transmission (see Job No. 26-1).

2. Press the spring clips (2) out of the throw-out fork (4) toward the rear and pull them out upward (Fig. 25-5/1).

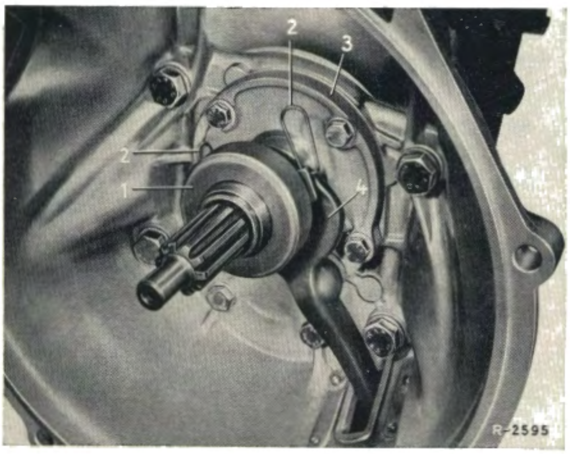


Fig. 25-5/1

1 Throw-out unit and bearing
2 Spring clip
3 Transmission case front cover
4 Throw-out fork

On the 300 SE cars with mechanical transmission remove the snap ring (7) by means of snap ring pliers (8). Remove the spring retainer (6) and the return spring (5) (Fig. 25-5/2).

3. Remove the throw-out unit (1) together with the throw-out bearing from the neck of the transmission case front cover (3).

4. To remove the bearing place the throw-out unit on the shop-made removing arbor (Fig. 25-5/3).

5. Grip the throw-out bearing and knock the removing arbor with the throw-out unit against a hard surface (Fig. 25-5/4).

Note: If the inner ring of the bearing should stick on the throw-out unit, it must be pulled off with a suitable puller or as an emergency measure be cut up.

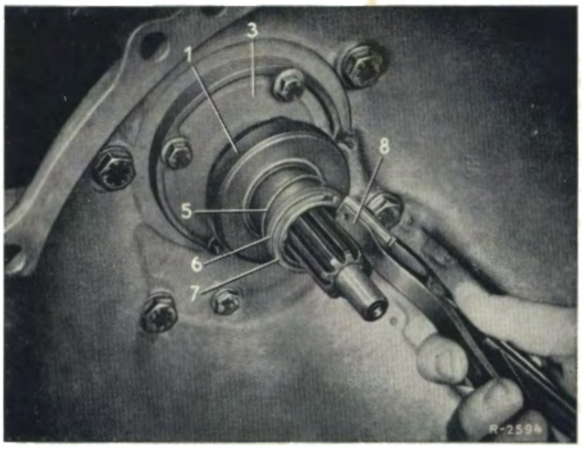


Fig. 25-5/2

1 Throw-out unit with bearing
3 Transmission case front cover
5 Return spring
6 Spring retainer
7 Snap ring
8 Snap ring pliers

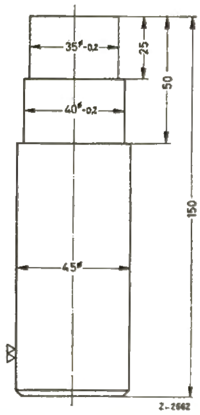


Fig. 25-5/3

Fig. 25-5/4

1 Throw-out bearing

Installation:

Important: The "new" throw-out unit and the "new" throw-out bearing can only be installed together to replace the previous parts.

Under no circumstances can a "new" throw-out bearing be installed with a throw-out unit of the previous version. The dimensional differences would make it practically impossible to adjust the clutch free play properly.

A throw-out bearing of the "previous" version will immediately become unserviceable if it is pressed on a "new" throw-out unit.

6. Give the neck on the throw-out unit a thin coat of a graphite lubricant.
7. Carefully press on the throw-out bearing.

Caution: Both the "previous" and the "present" versions of the throw-out bearing do not require any maintenance and should under no circumstances be washed out.

Note: Because of the oversize of the throw-out unit in relation to the throw-out bearing it is advisable to hypercool the throw-out unit before the bearing is pressed on. When cooling facilities are available the bearing neck need not be lubricated.

8. Fill the annular groove in the throw-out unit with Kenlube M 621 and give the sliding surfaces of the throw-out unit a thin coat of the same lubricant.
9. Apply a thin coat of a suitable graphite lubricant to the mounting tube of the transmission case front cover.
10. Push the throw-out unit on the mounting tube of the transmission case front cover and attach it to the throw-out (4) by means of the spring clips (2) (Fig. 25-5/1).

    On 300 SE Model cars reinstall the return spring (5), the spring retainer (6) and the snap ring (7) after the throw-out unit has been introduced into the throw-out fork (Fig. 25-5/2).
11. Reinstall the transmission (see Job No. 26-1).

Mechanical Transmission – Group 26

Removal and Installation of Transmission

Job No.
26-1

Modification: Revised and supplemented. Instructions on replacement of transmission on Model 300 SE added

Removal:

1. Disconnect the ground cable from the battery.

2. Press the selector rod (1) and the shift rod (2) off the ball stud of the selector lever (6) and the relay lever (4) of the steering column shift mechanism.

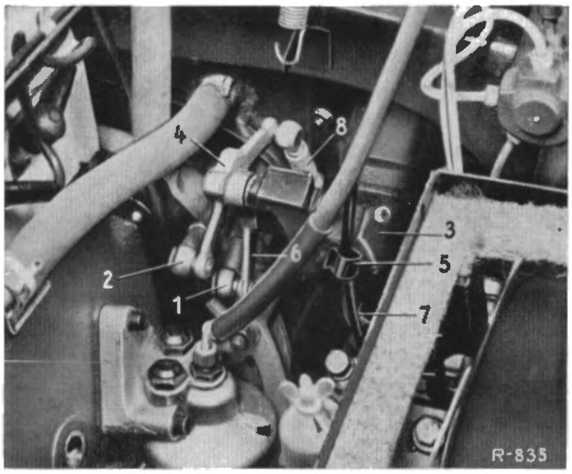


Fig. 26-1/1

1 Selector rod
2 Shift rod
3 Cover
4 Relay lever
5 Fixing clip
6 Selector lever
7 Flexible speedometer drive
8 Spring-loaded ball connector

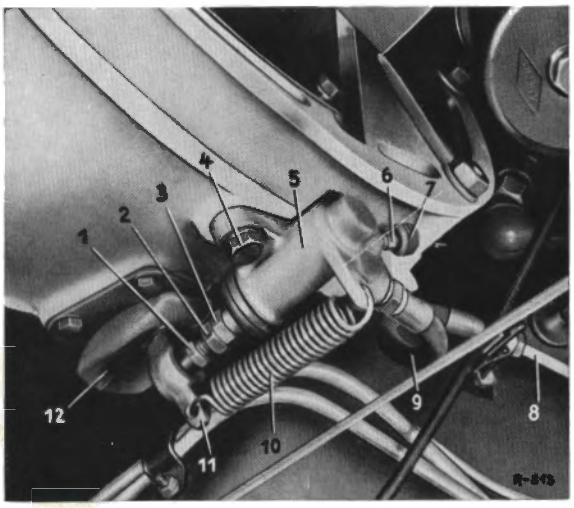


Fig. 26-1/2

1 Push rod
2 Hexagon nut
3 Pressure pin
4 Hexagon screw
5 Extraction cylinder
6 Bleed screw
7 Rubber cover cap
8 Line
9 Hose
10 Return spring
11 Throw-out fork
12 Cuff

3. Unscrew the extraction cylinder (5) for the clutch actuating mechanism at the clutch housing and remove (Fig. 26-1/2).

4. Disconnect the cable to the reversing light switch at the plug connection at the lower edge of the dashboard.

Note: This item does not apply in the case of cars supplied before April 1962, because the reversing light switch is located on the bearing assembly of the shift mechanism.

5. Unscrew the exhaust pipe bracket on the mounting plate (9), loosen the clamping screw and turn the bracket (4) downward.

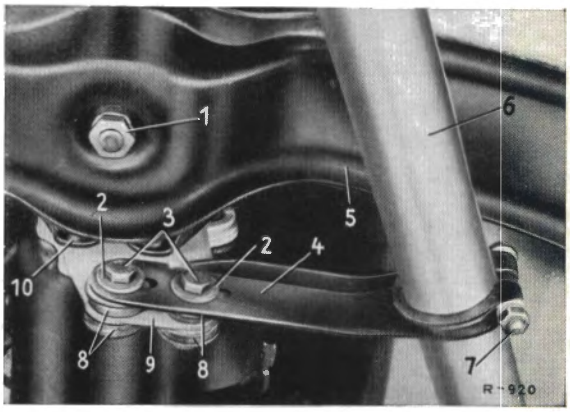


Fig. 26-1/3

1 Hexagon nut
2 Washer
3 Hexagon screw
4 Bracket
5 Support
6 Exhaust pipe
7 Hexagon screw (clamping screw)
8 Rubber washer
9 Mounting plate
10 Engine support

6. Mark the position of the rear support (12) in relation to the chassis base panel and remove the support from the chassis base panel. Loosen the center hand brake cable at the brake lever and remove from the cable guides of the front axle support and of the support. Then raise the engine a little at the back part of the oil pan until pressure is removed from the rubber mounting (14). Unscrew the hexagon nut (16) and the four hexagon screws (18) and remove the support (Figs. 26-1/4 and 26-1/10).

On Model 230 SL remove the tunnel cover plate and its 16 screws instead of the rear support.

Note: To avoid damaging the oil pan a suitable piece of wood must be placed between the jack and the oil pan.

7. Unscrew the engine support (3) with the rubber mounting (14) at the transmission case rear cover (8) and remove it together with the mounting plate (9) (see Fig. 26-1/8).

and push the propeller shaft back as far as possible, paying attention to the center cross (1) (Fig. 26-1/5).

Note: The propeller shafts of the new models as from August 1965 are no longer provided with a slip coupling. Instead the front part (1) of the two-unit propeller shaft of Models 200 D, 230, 230 S, 250 S, 250 SE, 300 SEb and 300 SEL has been provided with clamp nut (3) (see Fig. 26-1/7) and the intermediate shaft (4) of the three-unit propeller shaft on Model 200 and on the ambulance cars Models 200 D and 230 has been provided with two clamp nuts (3a and 3b) (see Fig. 26-1/8).

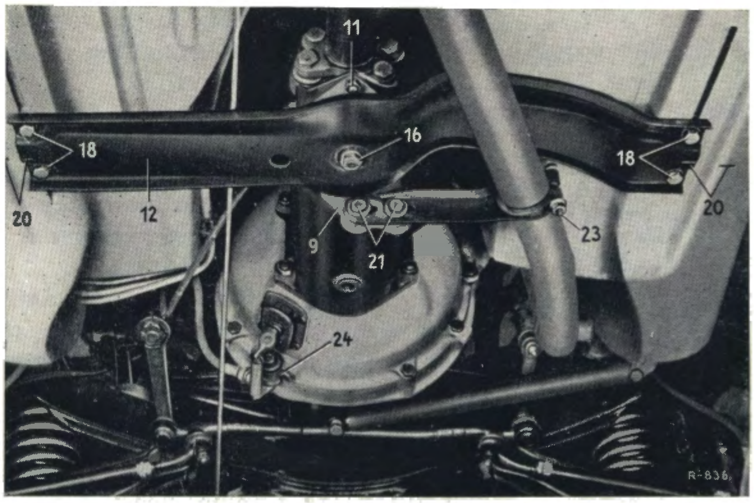


Fig. 26-1/4

9 Mounting plate
11 Rubber mounting
12 Rear bracket
16 Hexagon nut
18 Hexagon screw
20 Position markings
21 Hexagon screw
23 Hexagon screw
24 Extraction cylinder

8. Disconnect the propeller shaft (9) at the transmission; the shaft plate (11) remains attached to the transmission (Fig. 26-1/5).

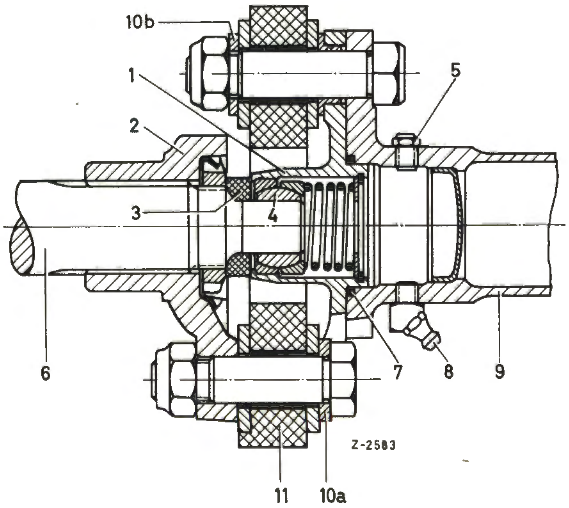


Fig. 26-1/5

1 Center cross
2 Three-way flange on the transmission main shaft
3 Rubber sealing ring
4 Locating ball
5 Relief valve
6 Transmission main shaft
7 Rubber sealing ring
8 Piston rim grease fitting
9 Front propeller shaft
10a Washer
10b Washer
11 Shaft plate

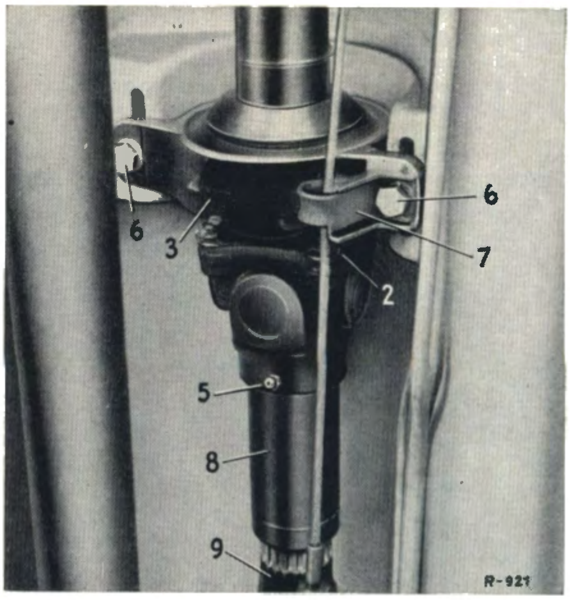


Fig. 26-1/6

2 Joint flange of front propeller shaft
3 Bearing bracket
5 Grease nipple for slip coupling
6 Hexagon screws for fastening the bearing bracket to the chassis base panel
7 Cable bracket
8 Slip coupling with universal joint of rear propeller shaft
9 Rear propeller shaft

9. Mark the position of the propeller shaft intermediate bearing on the chassis base panel, and then remove the two mounting screws for the propeller shaft intermediate bearing

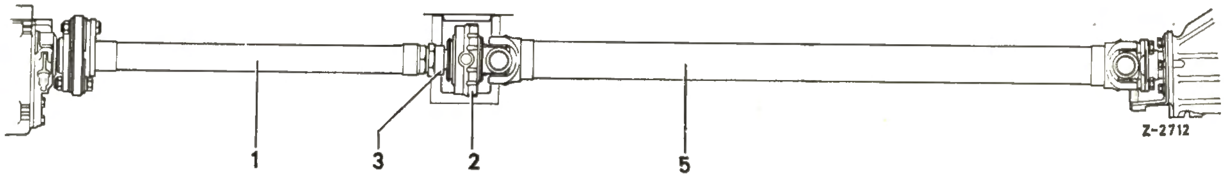
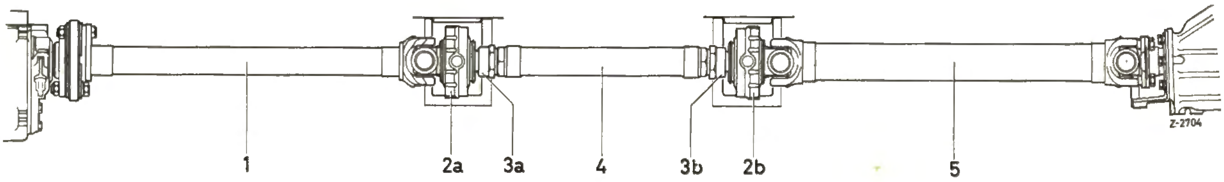


Fig. 26-1/7 2-unit propeller shaft

1 Front propeller shaft
2 Intermediate bearing
3 Clamp nut
5 Rear propeller shaft

Fig. 26-1/8 3-unit propeller shaft

1 Front propeller shaft
2a, 2b Intermediate bearing
3a, 3b Clamp nut
4 Intermediate bearing
5 Rear propeller shaft



When the transmission is being replaced these propeller shafts must be disconnected also at the rear axle, and after slackening the one or two intermediate bearings the whole assembly must be slightly pushed toward the rear.

10. Remove the sealing ring (3) from the transmission main shaft (6) (Fig. 26-1/5).

11. Disconnect the flexible speedometer drive at the transmission.

12. Unscrew the hexagon screws with which the clutch housing is attached to the intermediate flange.

13. Pull the transmission back and remove downward. For this purpose the transmission must be turned to the right, so that the recess on the clutch housing for the neck of the starter does not knock against the propeller shaft housing.

Important: In order to prevent damage to the driven plate the transmission should be moved backward **in a horizontal position** until the drive shaft is definitely disengaged from the hub of the driven plate. Under no circumstances must the transmission be lowered the moment it has been pulled out of the cylindrical centering device, or on Model 300 SE out of the dowel pins.

Note: It is advisable to remove and check the clutch at the same time (see Job No. 25-1).

If the transmission is to be cleaned the clutch throw-out bearing should always be removed beforehand.

The thrust bearing does not require any maintenance and becomes completely unserviceable if it is washed. It should be kept in a clean place until it is reinstalled.

Installation:

14. Give the journal and splines of the drive shaft a thin coat of grease. Install the transmission taking care to ensure that the selector and shift rods are in a forward position close to the clutch housing.

Note: The clutch housing with the flanged-on transmission on the 4 and 6 cylinder models is centered in relation to the engine by means of the cylindrical centering device on the clutch housing and intermediate flange.

The only exception are the 300 SE Models on which the transmission is centered in relation to the engine by two conical dowel pins. (See also "Important Instructions for Transmission Replacement on 300 SE Models at the end of this Job No.).

15. Screw the clutch housing with the transmission to the intermediate flange, at the same time screwing the ground cable of the battery to the hexagon screw behind the oil filter, and the ground cable from the engine to the body to the upper fixing screw of the starter. On the 300 SE Models the two conical dowel pins should be driven home by light hammer taps before the screws are finally tightened.

Note: The two long hexagon screws with which the starter too is fastened, must be tightened evenly, otherwise one of the fixing eyes of the starter may break off.

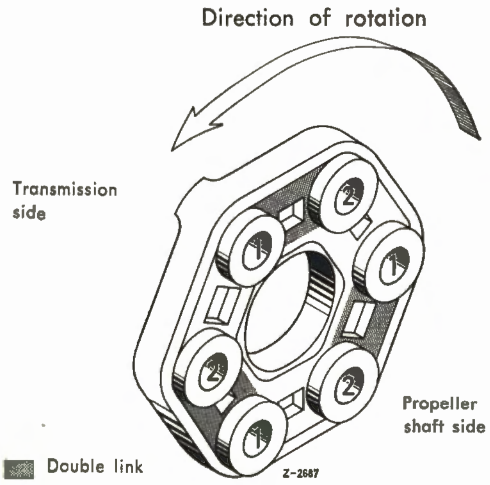


Fig. 26-1/9

16. Place the sealing (3) on the main shaft, push the propeller shaft forward and lightly screw the propeller shaft intermediate bearing to the chassis base panel.

17. Firmly screw the propeller shaft to the shaft plate paying attention to the center cross (1) (Fig. 26-1/5).

Note: The shaft plate must be installed in such a way that the double links are under tensile stress (see Fig. 26-1/9).

18. Then attach the propeller shaft intermediate bearing without forcing, noting the position marked during removal (see Fig. 26-1/6).

Note: The propeller shaft intermediate bearing should only be firmly tightened after the propeller shaft has been flanged to the transmission shaft plate.

Caution: On all new models as from August 1965 connect the two or three-unit propeller shaft to the rear axle. Make the fixing screws on the intermediate bearing finger-tight.
On the two-unit propeller shaft slacken the clamp nut (3) on the front shaft (1) and on the three-unit shaft slacken the front clamp unit (3a) on the intermediate shaft (4), using SW 41 und SW 46 wrenches respectively (see Figs. 26-1/7 and 8).
In this condition roll the car to and fro several times, then retighten the clamp nuts with a torque of approx. 20 mkg. and screw down the intermediate bearings without forcing (Figs. 26-1/7 and 26-1/8).

19. Connect the flexible speedometer drive to the transmission. Fasten the mounting plate (9) and the engine support (3) with the rubber mounting to the transmission case rear cover (8) (see Figs. 26-1/4 and 26-1/10).

20. Fasten the support (12) or the tunnel cover plate to the rubber mounting (14) (Fig. 26-1/10).

21. Screw the support (12) or the tunnel cover plate to the chassis base panel but do not tighten the hexagon screws (18). In this connection note the position marked (20). Now jack the car down and tighten the hexagon screws for fastening the support (see Fig. 26-1/4). On Model 230 SL the 16 screws can be tightened right away.

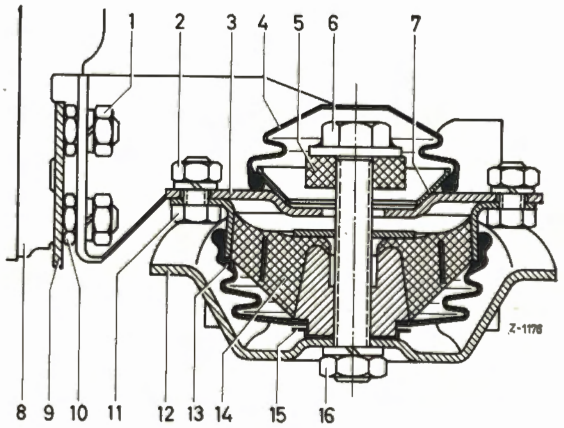


Fig. 26-1/10

1 Hexagon nut	9 Mounting plate
2 Hexagon nut	10 Hexagon collar screw
3 Engine support	11 Hexagon screw
4 Bellows	12 Support
5 Rubber pad	13 Bellows
6 Hexagon screw	14 Rubber mounting
7 Bellows bracket	15 Sheet-metal plate
8 Transmission case rear cover	16 Hexagon nut

22. Check the adjustment of the rear rubber mounting and if necessary readjust (see Job No. 24-1).

23. Fasten the exhaust pipe bracket (4) to the mounting plate (9) and tighten the clamping screw (7) (Fig. 26-1/3).

24. Fasten the extraction cylinder to the clutch housing.

25. Attach the return spring.

26. Adjust the clutch (see Job No. 29-6).

27. Pass the hand brake cable through the cable guides of the support and of the front axle support and fasten to the brake lever. Then adjust the hand brake.

28. Attach the selector rod and the shift rod to the ball studs of the steering column gear shift mechanism and adjust the gear shift mechanism (see Job No. 26-3).

29. Attach the ground cable to the battery.

30. Check the oil level in the transmission and if necessary correct.

Particularities of Floor-Mounted Gear Shift System

Para. 2.

Remove the two push rods (8) on top of the transmission case cover. Slacken the clamping screw (3) on the yoke end (2) and pull the shift tube (4) from the splines of the yoke end toward the rear (Fig. 26-1/11).

Para. 27.

Install and attach the two push rods (8) to the threaded bolts on top of the transmission case cover (Fig. 26-1/11). Insert the shift tube (4) in the splines of the yoke end and adjust the gear shift mechanism (see Job No. 26-3).

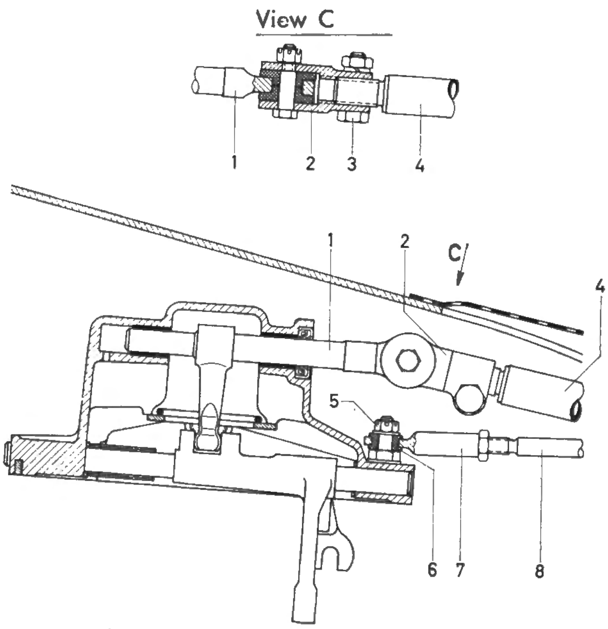


Fig. 26-1/11

1 Shifting shaft
2 Yoke end
3 Hexagon screw
4 Shift tube
5 Castle nut
6 Bushing
7 End piece
8 Push rod

Important Instructions for Transmission Replacement on 300 SE Models

In contrast to Models 190, 220 and 200, 230 and 250 with cylindrical centering device, the clutch housing of the 300 SE Models is still provided with dowel pins for centering as on the older models. During assembly in our factory the clutch housings are individually centered in relation to the engine, i. e. to the crankshaft, and are fixed in position by means of conical dowel pins. The engine number is then marked on the clutch housing between the two top fixing lugs. This individual procedure is necessary in order to achieve the accurate adjustment required for the DB automatic transmission. For reasons of production the cars with mechanical transmission are also equipped with these conical dowel pins.

As a result the clutch housing must never be detached from the engine when repair or replacement jobs are carried out no matter whether the car is equipped with a mechanical or an automatic transmission.

To prevent the danger of gears, in particular the 4th gear, slipping out, a new transmission is always combined with the clutch housing of the engine, even though new transmissions are always supplied together with a new clutch housing as in the case of the 190 and 220 Models. The new clutch should be disconnected, attached to the old transmission removed from the car and returned to the factory.
If the engine has to be replaced, the new engine is supplied together with a clutch housing which must be attached to the transmission installed in the car.

If, however, the clutch housing has to be replaced the new housing must be properly centered in relation to the engine.

Since on the present version mechanical transmission the clutch housing is installed between the transmission case front cover and the transmission case, the following jobs must be carried out whenever a transmission or an engine is replaced:

a) Proper positioning of drive shaft
b) Proper positioning of countershaft
c) Assembly of transmission and clutch housing.

If the clutch housing has to be replaced the following additional procedure is necessary:
d) Centering of the clutch housing in relation to the engine, i. e. to the crankshaft.

a) Proper Positioning of Drive Shaft

1. Remove old sealing compound from the jointing surface (transmission side) of the clutch housing associated with the engine.

2. Unscrew the clutch housing from the new transmission and carefully clean the front jointing surface of the transmission case.

3. Check the clearance between the upper edge of the snap ring on the grooved ball bearing and the recess in the clutch housing.

   Use a depth micrometer to measure the depth of the recess (Fig. 26-1/10a) and the distance between the front face of the snap ring on the grooved ball bearing and the jointing surface of the transmission case (Fig. 26-1/11a).

   When the distance is being measured the snap ring must lie snugly against the transmission case jointing surface and the space ring.

Fig. 26-1/10a

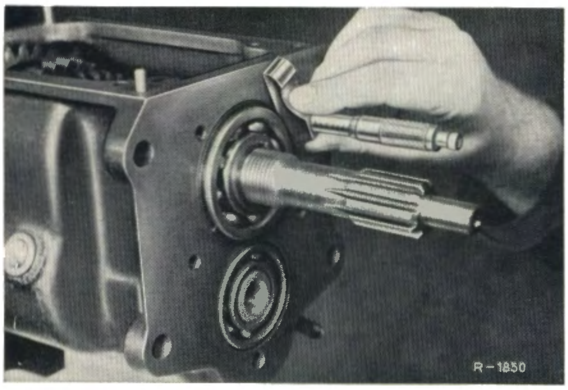


Fig. 26-1/11a

The clearance between grooved ball bearing and recess should be 0–0.10 mm. If the clearance is larger it can be reduced to the proper proportions by adding shims which are available in the following thicknesses:

0.1 mm, Part No. 136 262 06 52
0.2 mm, Part No. 136 262 07 52
0.3 mm, Part No. 136 262 08 52

b) Proper Positioning of Countershaft

Always measure the end play of the countershaft.

1. Push the countershaft back as far as it will go by light blows on its front part.

2. Use a depth micrometer to measure the distance between the face of the grooved ball bearing and the transmission case jointing surface.

3. Measure the depth of the lower recess in the clutch housing (see Fig. 26-1/12).

   The countershaft should have an end play of 0.10–0.15 mm. If a comparison between the two measurements proves that the play exceeds this limit it can be reduced to the proper proportion by inserting shim 120 263 17 52 in the clutch housing recess.

If no play or a play far below 0.10 mm. should be found the transmission case rear cover must be removed and the countershaft must be properly positioned in the rear bearing by removing the shim. If this procedure becomes necessary, first attach the clutch housing to the transmission (see Section C).

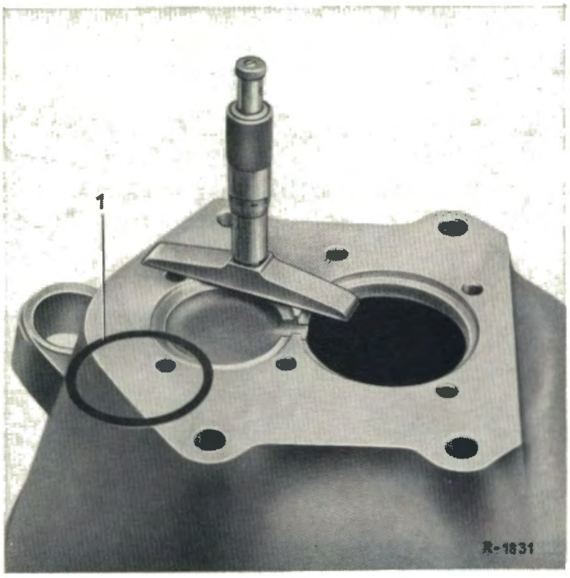


Fig. 26-1/12

1 Shim 120 263 17 52 gage 0.05 mm

Caution: Before loosening the grooved nut on the three-way flange remove the transmission case top cover and install Retaining Fixture 136 589 38 61 in the small gear section of the 1st and 2nd gear in such a way that the low gears are pushed toward the synchronising unit: this will prevent the key in the keyway of the stop ring from becoming dislodged (see Fig. 26-1/13).

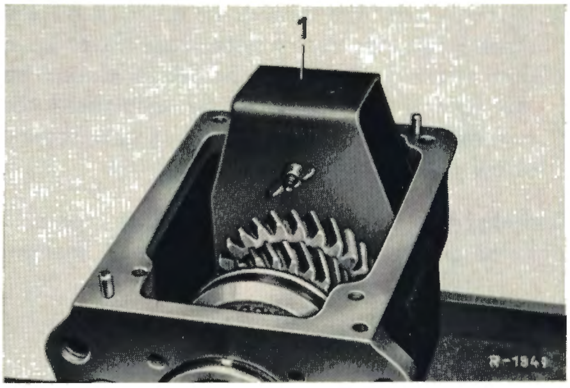


Fig. 26-1/13

1 Retaining Fixture 136 589 38 61

4. Then remove the transmission case rear cover and by light blows drive the countershaft forward again as far as it will go.

5. Remove all sealing compound and the old paper gasket from the jointing surface.

6. Proper positioning is achieved as described above, the only difference being that the thickness of the new paper gasket must be taken into account when measuring the transmission case rear cover.

Caution: In order to avoid the complications involved in removing the transmission case rear cover, the clutch housing has been changed as follows:

The recess depth for the front countershaft bearing in the clutch housing was increased from 2.0 + 0.2 mm. This 0.5 mm increase was compensated again by a 0.5 mm. shim Part No. 120 263 16 52 in order to retain the previous position of the countershaft. As before the countershaft is positioned during assembly in relation to the transmission case rear cover. However, if the clutch housing has to be replaced, the countershaft can now be repositioned with shims from the front side if the end play is too small.

c) Assembly of Transmission and Clutch Housing

1. Give the cleaned jointing surfaces of the clutch housing and the transmission case a thin but even sealing compound coat.

2. Slightly grease the previously selected shims and insert them in the recesses of the clutch housing and install the housing in the transmission case by fitting the recesses over the projecting grooved ball bearings.

3. Stick a new paper gasket to the transmission case front cover with grease and carefully slide the cover over the drive shaft into the recess in the clutch housing.

4. Liberally coat the threads of the 4 M 8 fixing screws for the transmission case front cover and of the 2 M 8 fixing screws arranged below it, and both faces of the associated corrugated washers with sealing compound, screw in and tighten.

Caution: The hexagon fixing screws come in three different lengths. The 30 mm. hexagon screw should go in the flatter fixing lug of the transmission case cover near the ball stud. The ball stud is also threaded and counts as a fifth fixing screw for the transmission case front cover.

5. Then screw in the 4 outer M 12 fixing screws.

d) Centering the Clutch Housing

The clutch housing can only be accurately centered when the engine has been removed from the car.

1. Unscrew the mechanical clutch from the flywheel.

2. Clean the flywheel and install a magnetic dial gage holder between the flywheel fixing screws (see Fig. 26-1/14).

3. Use 4 screws to attach the new clutch housing in such a way that it can still be shifted by light hammer blows.

4. Install a dial gage stand with Puppitast gage attached on the holder projecting through the top bearing bore in the clutch housing and align it in accordance with the internal diameter of the bore (see Fig. 26-1/15).

Note: When aligning the Puppitast gage remember its small range and adjust it to about the middle of this range to avoid the danger of forcing it beyond its range. A standard dial gage would not fit into the space available.

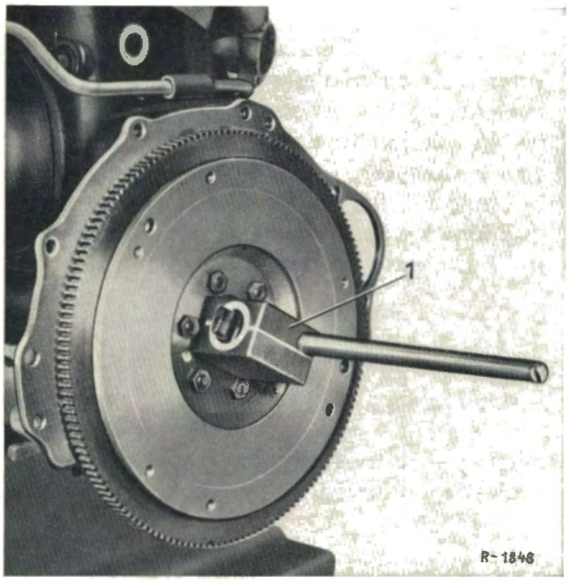


Fig. 26-1/14

1 Magnetic holder

5. Slowly turn the engine by hand and align the clutch housing by light hammer blows according to gage variations (see Fig. 26-1/15). Maximum permissible misalignment 0.05 mm.

Note: When the dial gage rotates the feeler must be lifted before it reaches the oil compensation groove.

6. Firmly tigthen the 4 fixing screws and bore the fitting holes to 12 mm ϕ.

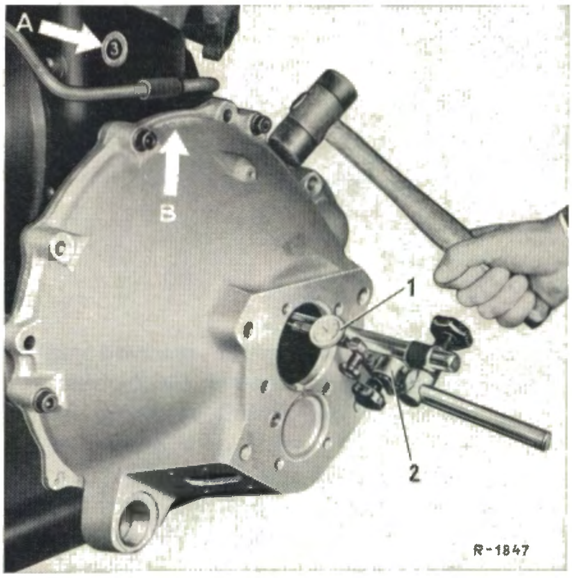


Fig. 26-1/15

A Punched in remaining misalignment in "hundredth of a millimeter"
B Engine number punched in
1 Puppitast
2 Dial gage stand

7. Ream up the bores with a conical 1:20 reamer.

8. Punch in the engine number between the two top fixing lugs of the clutch housing and punch in the remaining permissible misalignment in the white circle at the rear of the crankcase (see Fig. 26-1/15).

Job No.
26-3

Adjustment of Gear Shift Mechanism

Modification: Revised and supplemented

A. Adjustment of Steering Column Gear Shift Mechanism

1. Check the shift lever and the shift tube for freedom of movement.

Note: The shift lever should return automatically to the initial position when it is pulled up to the reverse stop.

2. Put the shift lever at the steering wheel in neutral, loosen the clamp screw (5) at the selector lever (6), pull the selector lever forward in the direction of travel. Pull the relay lever (4) forward by its lower leg. This engages the fourth gear (Figs. 26-11/1 and 2).

3. Remove the rubber sleeve on the shift lever from the recess of the steering column jacket. Now get an assistant to pull the shift lever on the steering wheel upward until there is a distance of about 2 mm between the shift tube collar and the recess in the steering column jacket.

4. Retighten the clamping screw (5) on the selector lever at the bearing assembly, pressing the selector lever toward the bearing assembley so that the spring washer (33) is pretensioned (Figs. 26-11/1 and 2).

5. Use the shift lever at the steering wheel to engage the various gears. All gears must be easy to shift. Always declutch when shifting the individual gears. When shifting into reverse, the mechanical resistance must be evident.

Note: If this is not the case, the reverse gear stop in the transmission case top cover must be checked and if necessary a new arresting spring must be installed.

6. Check the position of the shift lever at the steering wheel. In 2nd and 4th gear, the deviation of the lever from horizontal should be "a" (Fig. 26-3/1).

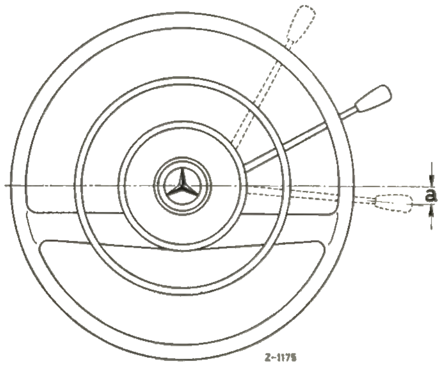


Fig. 26-3/1

a = deviation of the shift lever from horizontal in 2nd and 4th gear
a = approx. 15 mm

7. If there is any considerable deviation check the position of the lever in relation to the shift lever, the position of the shift lever on the transmission case top cover, and the length of the shift rod (Figs. 26-11/1 and 2).

Note: Small deviations can be corrected by shortening or lengthening the shift rod.
When changing gears the shift lever must have sufficient play in the recess of the steering column jacket.

B. Adjustment of Floor-Mounted Gear Shift System

1. Move the shifting shaft (1) against the reverse gear stop and engage 2nd gear by pushing in the shifting shaft (1) (Fig. 26-3/2).

2. Move the shift lever (16) to the 1st-2nd gear shifting plane (see right-hand sketch in Fig. 26-3/3) and insert the shift tube (4) in the serrations of the yoke end (2) (Fig. 26-3/2).

Note: The serrations on the shift tube (4) should project into the yoke end at least 15 mm. (Fig. 26-3/2, View C).

3. Tighten the clamping screw (3) in the yoke end.

4. Check the gear shift mechanism by shifting through all gears to make sure that they can be engaged easily. Under no circumstances must the shift lever knock against the shift lever bearing since there could be a danger that the gear will slip out.

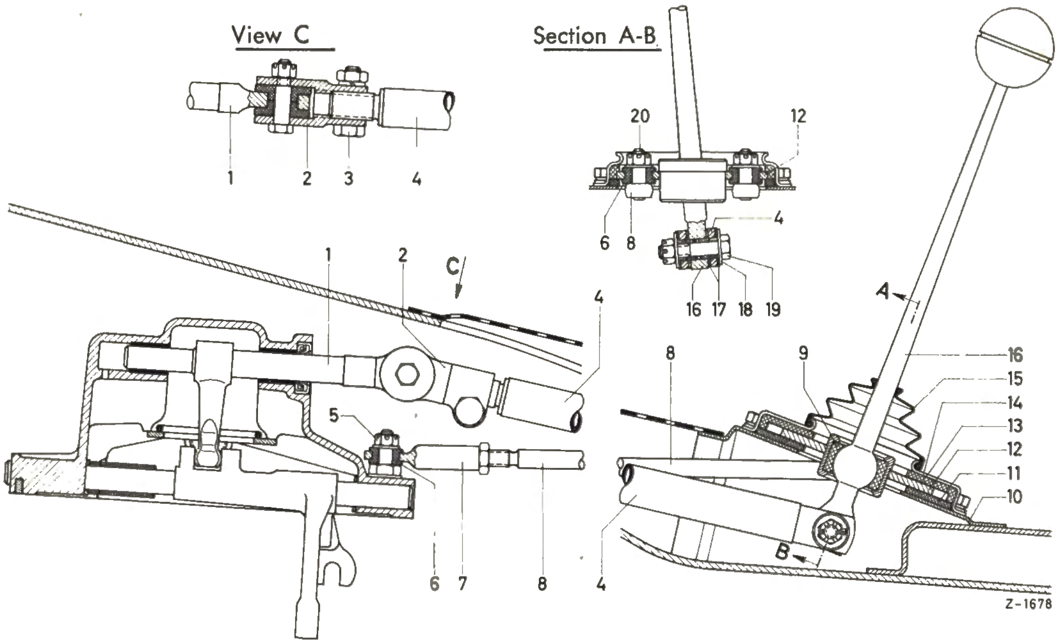
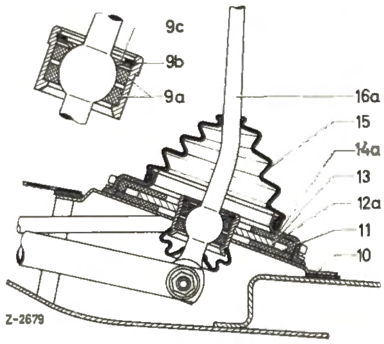


Fig. 26-3/2

2nd Version



1 Shifting shaft
2 Yoke end
3 Hexagon screw
4 Shift tube
5 Castle nut
6 Bushing
7 End piece
8 Push rod
9 Ball socket (vulcollan)
9a Split ball socket
9b Internal circlip
9c Corrugated washer
10 Transmission tunnel
11 Lower bearing cover
12 Shift lever bearing
12a Shift lever bearing, new version
13 Upper bearing cover
14 Cover plate 1st version, sheet metal
14a Cover plate 2nd version, vulcollan
15 Cuff
16 Shift lever
17 Bushing
18 Washer
19 Hexagon screw
20 Castle nut

When the shift lever is properly adjusted the shift positions will be as shown in Fig. 26-3/3.

If the shift lever knocks against the shift lever bearing (12) when a gear is being engaged, the length of the two push rods (8) should be adjusted (Fig. 26-3/2). To do this remove the push rods from the lug of the transmission case cover and turn the end pieces (7) until the bolts of the push rods (8) in the shift lever bearing (12) are situated in the center of the cover plate (14). The important point is that the two end pieces should always be adjusted by the same amount.

Caution!

As from November 1965 all cars with floor-mounted gear shift system are provided with a shift lever bent forward by 55 mm. in the direction of travel; the new design increases elbow room. There is no change in the lever positions in the direction of travel (see sketch on the right). At right angles to the direction of travel the lever positions have been shifted forward by approx. 55 mm. (see sketch on the left) compared with the previous version (see sketch in the middle) (Fig. 26-3/3).

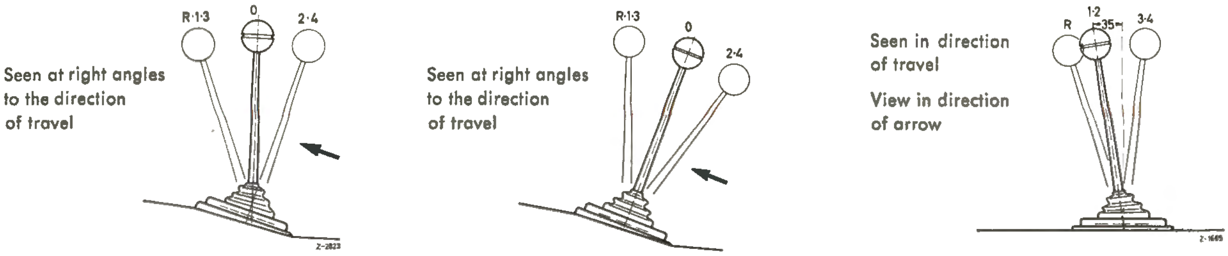


Fig. 26-3/3

Steering Wheel Shift System

Job No.
26-11

Modification: Revised and supplemented

A. General

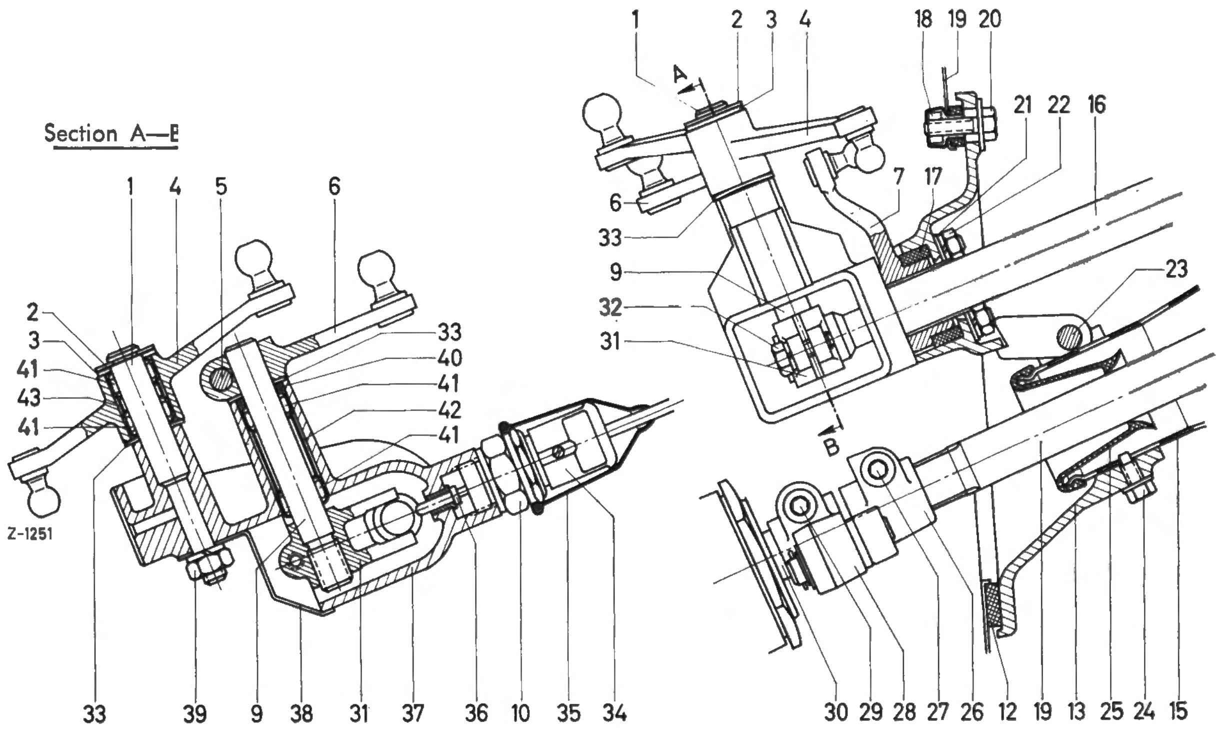


Fig. 26-11/1 **1st Version**

1 Relay lever shaft
2 Snap ring
3 Washer
4 Relay lever
5 Hexagon screw (clamping screw)
6 Selector lever
7 Lever on shift tube
9 Selector shaft
10 Reversing light switch
12 Rubber gasket
13 Cover plate
15 Steering column jacket
16 Shift tube
17 Vulkollan bushing
18 Cage nut
19 Steering tube
20 Hexagon screw with washer
21 Washer
22 Hexagon nut with lock washer
23 Hexagon screw (clamping screw)
24 Stud screw with lock washer
25 Rubber sleeve
26 Upper flange
27 Hexagon socket screw
28 Lower flange (clamping screw)
29 Hexagon socket screw (clamping screw)
30 Steering worm
31 Selector lever on shift tube
32 Hexagon screw (clamping screw)
33 Spring washer
34 Plug connection
35 Protective cap
36 Pressure pin
37 Bearing assembly
38 Cover
39 Hexagon nut with lock washer
40 Sealing ring
41 Needle bearing
42 Spacer sleeve
43 Spacer sleeve

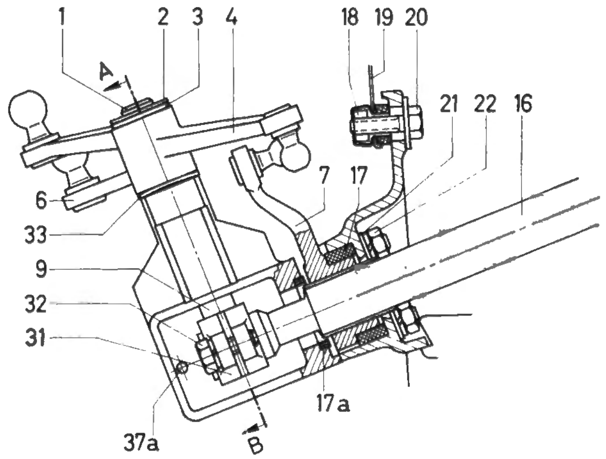


Fig. 26-11/2 **2nd Version**

1 Relay lever shaft
2 Snap ring
3 Washer
4 Relay lever
6 Selector lever
7 Lever on shift tube
9 Selector shaft
16 Shift tube
17 Vulkollan bushing
17a Spacer ring
18 Cage nut
19 Front panel
20 Hexagon screw with washer
21 Washer
22 Hexagon nut with lock washer
31 Selector lever on shift tube
32 Hexagon screw (clamping screw)
33 Spring washer
37a Water outlet bore

On the 3rd version the reversing light switch (10) is not required.

In order to improve gear shifting, individual parts of the steering wheel shift mechanism were changed as follows:

1. Bearing Assembly

If there is any misalignment between the front panel and the steering column jacket support on the instrument panel, the shift tube may in some cases show a tendency to jam. To counteract this tendency, a spacer ring (17a) was incorporated in the 2nd version bearing assembly. This spacer ring, which is slightly elastic, prevents the lever (7) from fouling the bearing assembly (Fig. 26-11/2).

In this connection the Vulkollan bushing (17) was made wider in order to prevent the lever (7) from fouling the cover plate. Furthermore, a water outlet bore (37a) with a 5 mm dia. was drilled into the 2nd version bearing assembly at its lowest point. This hole can also be subsequently drilled into the 1st version bearing assembly (Fig. 26-11/2).

Note: Water accumulating in the bearing assembly may cause corrosion and will make gear shifting difficult in very cold weather because of the formation of ice.

2. Lever on Shift Tube

The double bevel on the serrations of the lever (7) was increased in order to ensure that the lever cannot foul the lower part of the splines of the shift tube (16) (Fig. 26-11/2).

3. Spring-Loaded Ball Connector

The spring-loaded ball connector has been replaced by a rigid connecting rod. The rigid connecting rod can also be installed subsequently in place of the spring-loaded ball connector (for adjusting dimensions see (Fig. 26-11/3).

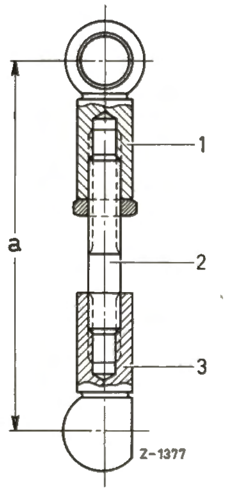


Fig. 26-11/3

1 Ball connector
2 Stud bolt
3 Ball connector
a = Adjusting dimension = 67 mm

4. Actuation of Reversing Light Switch

The pressure pin (36) has been increased in length (for length see Job No. 26-0) and the recess in the end section of the shift tube has also been increased (Fig. 26-11/1) in order to ensure instant response of the reversing light switch.

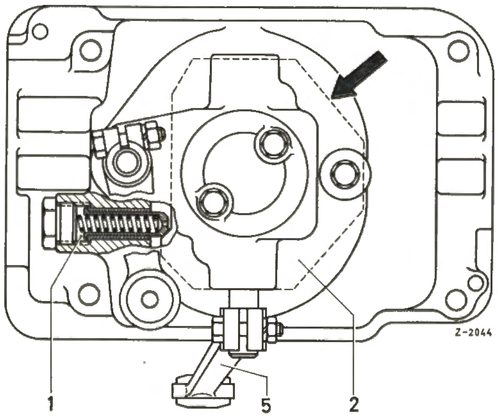


Fig. 26-11/4

previous version

1 Reverse gear interlock
2 Guide plate
3 Reversing light switch

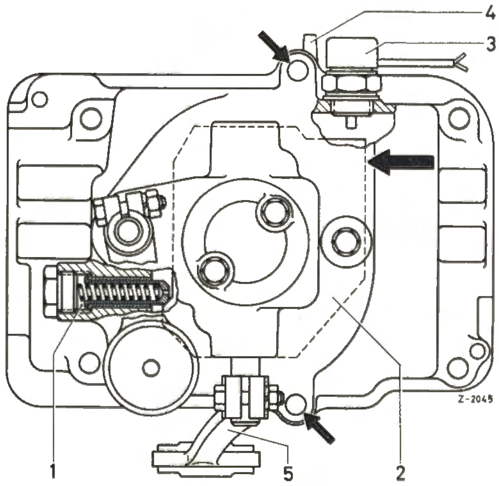


Fig. 26-11/5

present version

4 Stop web
5 Shift lever

In April 1962 the reversing light switch (3) was shifted from the bearing assembly to the transmission case top cover. This change was made

on model	190 c	as from chassis end no.	017 049
	190 Dc		023 538
	220 b		034 565
	220 Sb		073 730
	220 SEb		028 560

As a result the guide plate (2) in the transmission case had to be modified (see large arrows in Figs. 26-11/4 and 5).

At the same time the transmission case top cover was provided with two additional fixing holes and is now fastened with 6 screws (see small arrows in Fig. 26-11/5). The additional eye for the center fixing hole on the left-hand side of the transmission case top cover made it necessary to install a bent shift lever (5) (Fig. 26-11/5).

B. Checking of Grear Shift Mechanism

Stiffness and binding of the steering wheel shift system may be due to the following causes:

1. The shift tube (16) touches the steering column jacket passage or the felt in the steering column jacket and the leve (7) cannot move freely in the bearing of the 1st version bearing assembly (see Fig. 26-11/1). In this case loosen the cover plate (13) on the cowl and correct any misalignment by shifting the position of the cover plate. It is advisable at the same time to loosen the tightening strap (6) for the steering column jacket in order to ensure that the steering column jacket can be fastened to the cowl and to the tightening strap without forcing (see Fig. 26-12/4).
2. If the selector lever (31) binds in the recess of the shift tube (16), the selector lever must be removed and should be checked in order to make sure that it can move freely in the end section of the shift tube (Fig. 26-11/1). The selector lever must have a slight amount of radial and end play. If necessary, the claws of the selector lever can to some extent be bent apart or can be ground down.
3. If there is a certain amount of stiffness of the ball sockets of the selector rod (1) and the shift rod (2) on the ball heads of the relay lever and the selector lever (see Fig. 26-12/2), press off the ball sockets and lightly grease them. If this is not sufficient to remove the stiffness of the ball sockets, the condition can be improved by using a pair of pliers on the ball sockets.
4. If there is too much friction between the rubber cover (22) and the shift tube (16) (see Fig. 26-15/1), rub talc on the rubber cover or install the modified rubber cover Part No. 111 268 0197.
5. It is possible that the bearing assembly has worked loose because of strained or dislodged stud bolts. If this is the case replace the whole bearing assembly.

   When tightening the 4 fixing nuts never exceed a tightening torque of 0.6 mkg.

Job No. 26-12

Removal and Installation of Bearing Assembly

Modification: Rigid connecting rod (Fig. 26-12/6) added

Removal:

1. Detach the shift rod (2) and the selector rod (1) at the relay lever (4) and the selector lever (6) (Fig. 26-12/2).

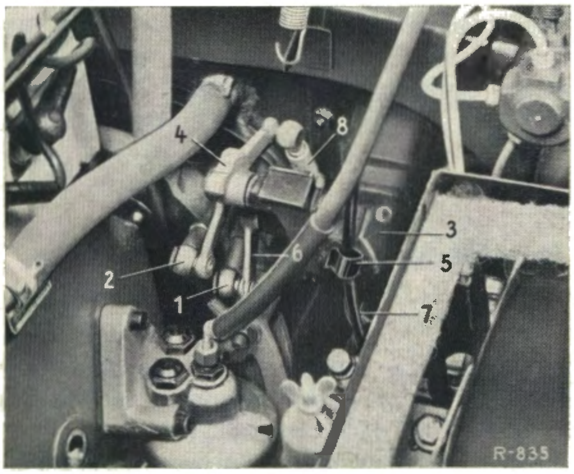


Fig. 26-12/2

1 Selector rod
2 Shift rod
3 Cover
4 Relay lever
5 Clip
6 Selector lever
7 Flexible speedometer drive
8 Spring-loaded ball connector

2. Remove the flexible speedometer drive from the fixing clip (5) of the cover (3). Unscrew the hexagon nut and remove the cover from the bearing assembly (Fig. 26-12/2).

3. Take the locking clamp from the ball sockets of the spring-loaded ball connector (8) and then pull off and remove the spring-loaded ball connector from the ball head of the relay lever (4) and the lever (7) (Fig. 26-12/3).

4. Unscrew the reversing light switch (10) from the bearing assembly (37) and take out the pressure pin (36) (Fig. 26-12/1).

Note: On cars supplied after April 1962 this procedure is not required since the reversing light switch is installed in the transmission case top cover.

5. Loosen the hexagon screw (32) in the selector lever (31), push the selector lever (6) with the selector shaft (9) to the right toward the center of the car, and remove the selector lever (31) upward (Fig. 26-12/).

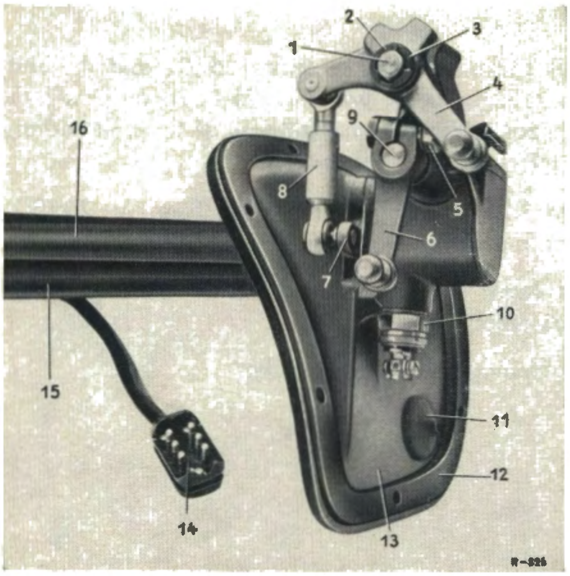


Fig. 26-12/3

1 Shaft
2 Snap ring
3 Spring washer
4 Relay lever
5 Hexagon nut
6 Selector lever
7 Lever on shift tube
8 Spring-loaded ball connector
9 Selector shaft
10 Reversing light switch
11 Rubber grommet
12 Rubber gasket
13 Cover plate
14 Plug connection
15 Steering column jacket
16 Shift tube

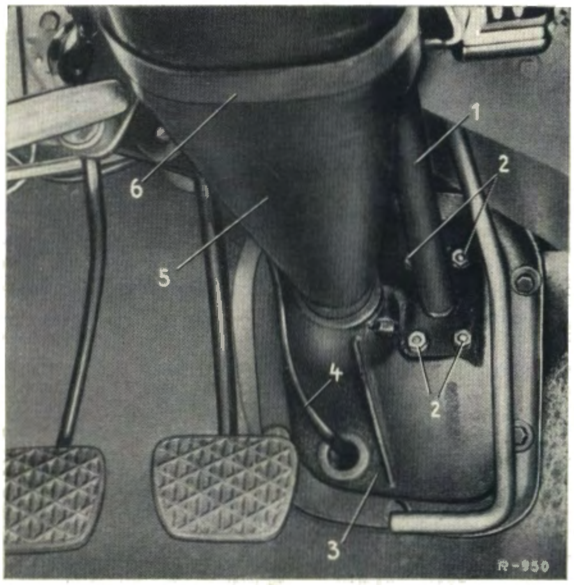


Fig 26-12/4

1 Shift tube
2 Hexagon nuts for attaching the bearing assembly of the steering wheel shift system
3 Cover plate
4 Cable for reversing light switch
5 Steering column jacket
6 Tightening strap for steering column jacket

26-12/1

6. Take out the rubber mat and unscrew the four hexagon screws (2) (Fig. 26-12/4).

7. Remove the bearing assembly. Then remove the lever (7) from the splines of the shift tube (16) (see Fig. 26-12/3).

8. Check the polyamide bushing (2) in the spring-loaded ball connector (Fig. 26-12/5). To do this compress the ball connector as far as the stop and let it go again. If a metallic noise can be heard at one of the stops, the polyamide bushing is damaged and the ball connector must be replaced.

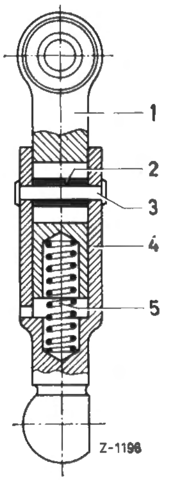


Fig. 26-12/5

1 Spring-loaded ball connector
2 Polyamide bushing
3 Cylindrical pin
4 Spring-loaded ball connector (outer part)
5 Pressure spring

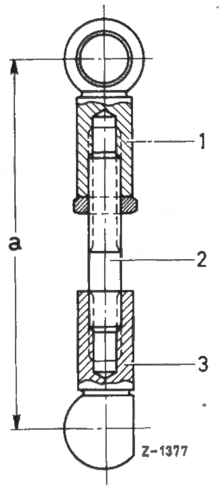


Fig. 26-12/6

1 Ball connector
2 Stud bolt
3 Ball connector
a = Adjusting dimension = 67 m

Note: The spring-loaded ball connector has been replaced by a rigid connecting rod. The rigid connecting rod can also be installed subsequently in place of the spring-loaded ball connector. Adhere strictly to the dimension "a" of the rigid connecting rod (Fig. 26-12/6).

9. Check the seat of the relay lever (4). The spring washer (33) installed between the relay lever (4) and the bearing assembly (37) must have sufficient initial tension (Fig. 26-12/1).

10. Check the radial play of the selector lever shaft (9) in the bearing assembly (37) and of the relay lever (4) on the shaft (1).

11. Check the end play of the selector lever (31) in the shift tube (16) (for dimensions see Job No. 26-0), since excessive play may make gear shifting difficult.

12. Push the lever (7) onto the splines of the shift tube (16). The lever must be easy to shift in the axial direction and must not bind.

13. Check the radial play of the lever (7) in the Vulkollan bushing (17). If the play is excessive, replace the bushing in the cover plate (13). (Fig. 26-12/1).

Installation:

14. Grease the splines of the shift tube (16) and the Vulkollan bushing (17) (Fig. 26-12/1).

15. Put the shift lever at the steering wheel in the horizontal position.

16. Slide the lever (7) onto the shift tube (16) in such a way that the collar of the lever points upward.

Note: The lever must be slid onto the splines of the shift tube in such a way that the shift lever cannot foul the steering column jacket. The movement of the lever must be limited by its contact with the recess of the cover plate.

17. Attach the bearing assembly (37) to the cover plate (13) of the steering column jacket (15) (Fig. 26-12/1).

18. Install the spring washer (33) on the selector shaft (9) and lightly grease the shaft.

19. Install the selector lever (31) in the shift tube (16) and insert the selector shaft in the serrations of the claw, and tighten the hexagon screw (32).

Note: The hexagon screw in the selector lever (31) must point in the direction of travel.

20. Fit the cover (38) to the bearing assembly (37) and fasten it by means of the hexagon nut (39) (Fig. 26-12/1).

21. Attach the flexible speedometer drive in the fastening clip.

22. Press the spring-loaded ball connector (8) or a rigid connecting rod on the ball heads of the relay lever (4) and the lever (7) and install the locking clamp (Fig. 26-12/3). Adhere strictly to the dimension "a" of the connecting rod.

23. Insert the pressure pin (36) in the bearing assembly (37) and screw in the reversing light switch (10). Plug in the plug connection (34) for the reversing light switch (Fig. 26-12/1).

Note: For cars supplied after April 1962 this procedure is not required.

24. Grease the ball heads of the shift lever and selector lever and press them onto the shift and selector rods.

25. Adjust the gear shift mechanism (see Job No. 26-3).

Removal and Installation of Floor-Mounted Gear-Shift System

Job Nr.
26-25

Modification: 2nd version shift lever bearing added

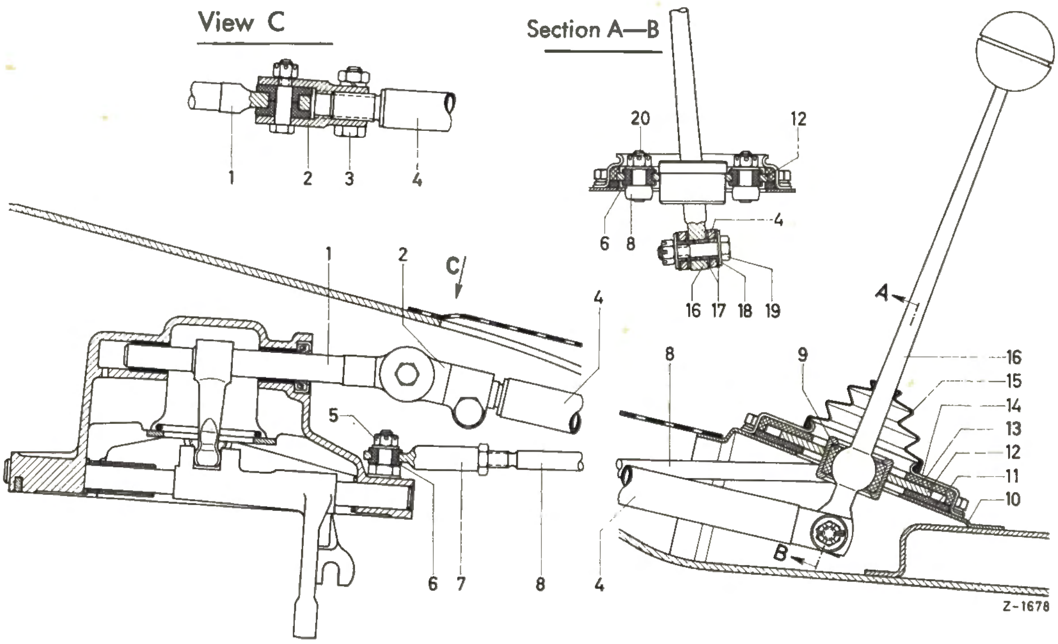
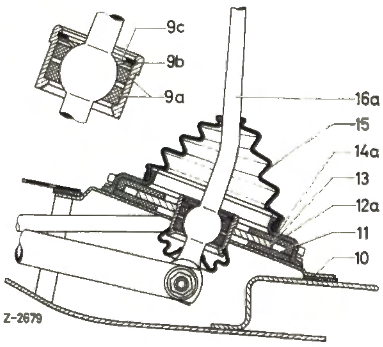


Fig. 26-25/1

2nd Version



1 Shifting shaft
2 Yoke end
3 Hexagon screw
4 Shift tube
5 Castle nut
6 Bushing
7 End piece
8 Push rod
9 Ball socket
9a Split ball socket
9b Internal circlip
9c Corrugated washer
10 Transmission tunnel
11 Lower bearing cover
12 Shift lever bearing
12a Shift lever bearing new version
12a Shift lever bearing new version
13 Upper bearing cover
14 Cover plate 1st version, sheet metal
14a Cover plate 2nd version, vulcollan
15 Cuff
16 Shift lever
17 Bushing
18 Washer
19 Hexagon screw
20 Castle nut

Removal:

1. Remove the two push rods (8) on top of the transmission case cover (Fig. 26-25/1).

2. Loosen the clamping screw (3) on the yoke end (2) and pull the shift tube (4) from the splines in the yoke end toward the rear (see View C in Fig. 26-25/1).

3. Remove the shelf between the front seats and remove the carpet on the transmission tunnel.

4. Unscrew the cover plate (14) on the shift lever bearing and pull out the shift lever as far as possible.

5. Now unscrew one of the two push rods (8) on the shift lever bearing.

   After these preliminary procedures the shift lever together with the shift tube can be removed from the transmission tunnel.

6. If the ball socket (9) is worn, remove the shift lever and press the ball socket out of the shift lever bearing.

Note: The shift lever bearing (12) and the ball socket (9) have been modified (see Fig. 26-25/1). In the new shift lever bearing 12a the top and bottom internal collars have been replaced by a top internal circlip and a spring washer. The ball socket has been split (9a).

This modification greatly facilitates replacement of the ball socket.

Installation:

Installation of the gear shift lever is the reverse of the removal procedures with the necessary modifications.

7. Grease the outside of a new ball socket before installation and the inside after installation. The new split ball sockets (9a) can be pressed into the bearing (12) by hand and only need internal greasing.

Important: The ball sockets should only be lubricated with vaseline or grease.

Under no circumstances should oil be used for lubrication.

Oil lubrication causes binding of the shift mechanism.

8. The shift tube (4) is inserted in the yoke end (2) when the shift mechanism is being adjusted, for which see Job No. 26-3.

Automatic DB Transmission Group 27

Job No.
27–0

Automatic DB-Transmission

General Data, Dimensions and Limits

Terminal Voltage

On double acting solenoid	min. 10.8 Volt
On solenoid for kickdown	min. 10.8 Volt

Modulating Pressure

Modulating Pressure	kg/cm^2
Basic pressure Maximum pressure Kickdown modulating pressure	0.9+0.1 2.9 4.6—0.2

Shift Points*

Gear shift mechanism			1st/2nd Gear		2nd/3rd Gear		3rd/4th Gear		Maximum speed in the various gears in km/h
			upshift	downshift	upshift	downshift	upshift	downshift	
selector lever position	gas pedal position	Governor Model[1]	Speeds in km/h at shift point						
4	partial throttle	I	—	—	28	23	40	30	
		II	—	—	28 B	23 G	40 C	30 H	
		III	—	—	25	18	40	30	
		IV	—	—	25	18	45	30	
	full throttle	I	18[2]	—	48	23	76	30	
		II	18[2] A	—	40 C	23 G	85 E	30 H	
		III	18[2]	—	40	18	100	30	
		IV	18[2]	—	45	18	120	30	
	kickdown	I	28	10–12	48	30	76	66	
		II	28 B	10–12 F	54 D	30 H	85 E	75 J	
		III	25	10–12	58	30	100	85	
		IV	25	10–12	75	30	120	105	
3	partial throttle	I	—	—	28	23	—	—	
		II	—	—	28 B	23 E	—	—	
		III	—	—	25	18	—	—	
		IV	—	—	25	18	—	—	
	full throttle	I	18[2]	—	48	23	—	—	86
		II	18[2] A	—	54 C	23 E	—	—	86
		III	18[2]	—	58	18	—	—	115
		IV	18[2]	—	75	18	—	—	130
	kickdown	I	28	10–12	48	38	—	—	
		II	28 B	10–12 D	54 C	44 F	—	—	
		III	25	10–12	58	46	—	—	
		IV	25	10–12	75	64	—	—	
2	partial throttle	I	15	10	—	—	—	—	
		II	15 A	10 C	—	—	—	—	
		III	15	10	—	—	—	—	
		IV	15	10	—	—	—	—	
	full throttle	I	15	10	—	—	—	—	55
		II	15 B	10 C	—	—	—	—	55
		III	40	10	—	—	—	—	70
		IV	45	10	—	—	—	—	80
	kickdown	I	28	23	—	—	—	—	
		II	28 B	23 D	—	—	—	—	
		III	40	30	—	—	—	—	
		IV	45	30	—	—	—	—	

Note: All values are approximate. The letters A, B, C etc. opposite the speed values refer to the diagrams in Job No. 27–1.

[1]) Governor Model I: Installed in transmission of Model 190 Dc, 1st version
Governor Model II: Installed in transmission of Model 190 Dc, 2nd version
Governor Model III: Installed in transmission of Models 190 c, 220 b, Sb, SEb, 300 SE with 160 HP engine and transmission versions 1 and ST
Governor Model IV: Installed in transmission of Models 230 SL, 300 SE with 170 HP engine and standard transmission (at rear axle ratio 3.92:1 speeds are lower by approx. 4%).

[2]) Does not apply unless 1st gear was engaged by kickdown.

Adjustment Data

	Fig. No.	Adjusting Value
Play "a" between starter locking switch and cam disk	27–4/1	1±0.3
* Longitudinal adjustment "b" of spring-loaded connecting rod	27–4/8	298±1
* Switch-off speed of idling switch (max.)	–	1,600 r.p.m.
* Adjustment of modulating pressure control with graduated disk on Diesel engine cars		
Full throttle value	27–4/7	39°–0.5°
Basic adjustment value (beginning of pressure rise)	27–4/7	41°–0.5°

Screws and Tightening Torques

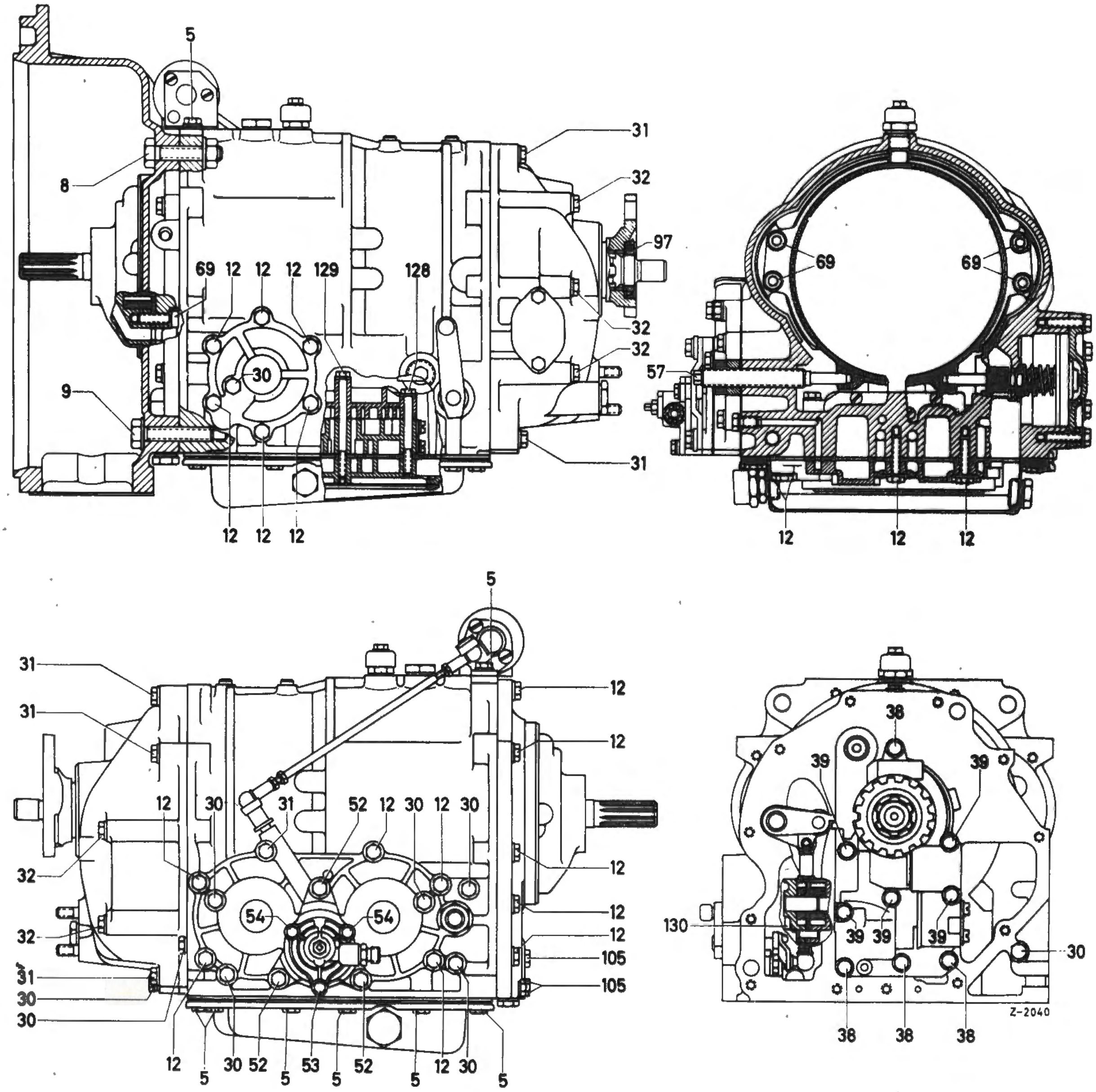


Fig. 27–0/1

Item	Screw Designation	Dim.	Tighten-ing Torque mkg	Item	Screw Designation	Dim.	Tighten-ing Torque mkg
5	Hex screw Oil pan	M 7×20	0.8	69	Hex socket screw	M 8×25	2
	Others	M 7×20	1.3	97	Slot screw for propellor shaft flange	–	8
8	Hex screw with nut	M 12×55	6				
9	Hex screw	M 12×55	5	105	Hex screw	M 7×35	1.3
12	Hex screw	M 7×30	1.3	128	Hex screw	M 6×60	0.8
30	Oil pressure test plug	–	–	129	Hex screw	M 6×75	0.8
31	Hex screw	M 7×40	1.3	130	Hex socket screw	M 6×50	1
32	Hex screw	M 7×80	1.3				
38	Hex screw	M 6×22	0.8		Drive disk:		
39	Hex screw	M 6×65	0.8		(Fluid coupling)		
52	Hex screw	M 7×55	1.3	–	Hex socket screw	M 8×15	3
53	Hex screw	M 5×40	0.7		All models except 300 SE		
54	Hex screw	M 5×15	0.7	–	Hex screw Model 300 SE only	M 8×15	3
57	Adjusting screw for B 3	–	0.5				

Automatic DB Transmission

A. Operation

a) General Remarks

The Automatic DB Transmission is a fully automatic 4-speed transmission which eliminates conventional clutching and shifting. Under normal circumstances the transmission changes up and down through the gears in accordance with the speed and the gas pedal position. After setting the desired "driving position" all the driver does is accelerate or brake.

A special characteristic of the Automatic DB Transmission is that the driver can intervene at any time and change to manual shifting depending on driving conditions or the driver's disposition. Below the steering wheel on the steering column or on the transmission tunnel the former gear shift lever has been replaced by a so-called selector lever by means of which, according to prevailing driving conditions (direction and road condition) six different functional ranges of the automatic transmission can be selected. The position of the selector lever is transmitted to a selector lever position indicator mounted on the instrument panel or it is visible on the gear shifting gate on the transmission tunnel so that the driver is always informed about the selected functional range.

b) Functional Ranges

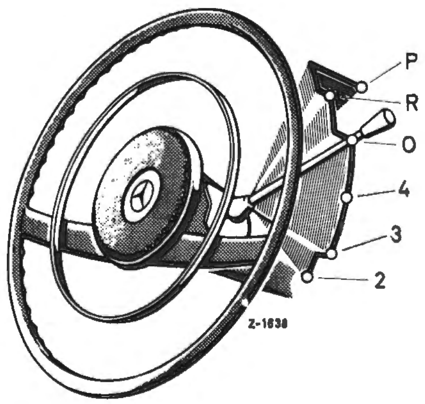


Figure 27–1/1 a
1st version

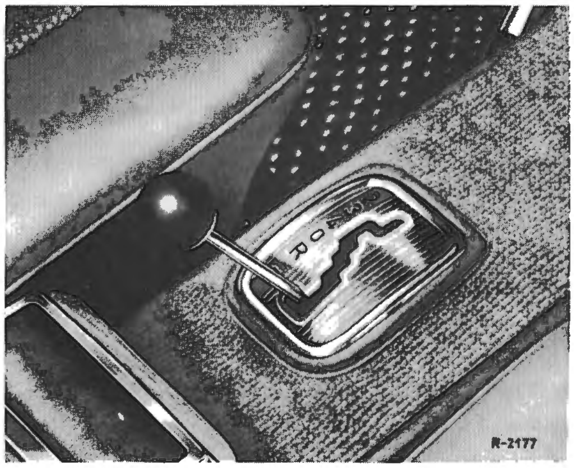


Figure 27–1/2
Floor-mounted selector lever

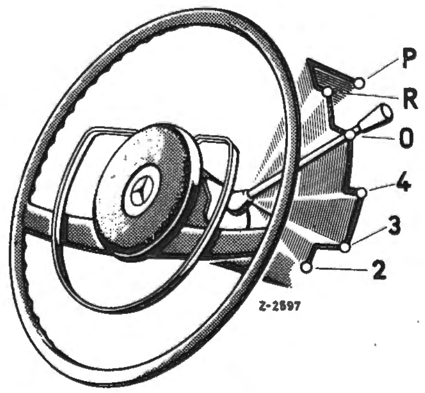


Figure 27–1/1 b
2nd version

P = Parking and starting position
R = Reverse
0 = Idling and starting position
4 = Normal driving
3 = Driving on average grades and slopes
2 = Driving on steep mountain passes, in convoy with repeated starting and with a trailer in the mountains.

Figure 27–1/1 c

For forward driving, where the actual automatic operation occurs, there are 3 selector lever positions (4, 3 and 2) available. The numerals 4, 3 and 2 indicate up to which gear the transmission will change up in each case. The other three selector lever positions, idling (0), reverse (R) and parking (P) are gear positions which are independent of the automatic system. The selector lever is easily moved to the various positions; but it must be raised to pass a notch when "P" or "R" or "2" are selected, also to shift from "P" into another position (Fig. 27–1/1). In the case of the 2nd version the selector lever must also be raised for a shift from position "4" to position "0" (Fig. 27–1/1 b).

Corresponding to the four gear steps for forward driving the entire driving speed range is subdivided into four individual ranges. Within each one of these individual ranges two of the four forward speeds are available, with the exception of the 4th range, in which only 4th gear is available.

In the 1st speed range 1st and 2nd gear are available.

In the 2nd speed range 2nd and 3rd gear are available.

In the 3rd speed range 3rd and 4th gear are available.

In the 4th speed range only the 4th gear is available.

The lower of the two gears in each speed range may be maintained up to its upper range limit on full throttle or kickdown; changing up to the higher of the two gears is already effected earlier when returning from full throttle or kickdown to reduced throttle.

Changing down into the lower one of the two available gears within each speed range is only possible under kickdown.

Basically the pedal position and the shift moment are related as follows:

Opening throttle = late changing-up = heavy acceleration.
Closing throttle = early changing-up = weak acceleration.

Selector lever in position "P" = Parking and starting position

In this position the output shaft of the transmission is locked against a stop in the gear box which in turn blocks the rear axle to prevent unintentional rolling-off of the vehicle. This rolling-off protection is required because a hydraulic clutch has no mechanical connection between engine and rear axle.

Shift selector lever to position "P" only when the vehicle is stopped. When parking be sure to pull the hand brake

The selector lever may be shifted to position "P" with the engine running or stopped. To protect the gears a hydraulic interlock is provided which inactivates any unintentional shifting of the selector lever into position "P" from speeds of approx. 10 km/h (6 miles/h) upwards while driving in forward direction.

The engine may be started with the selector lever in the above position.

Selector lever in position "R" = Reverse

Place selector lever into position "R" only when the vehicle is stopped. For safety reasons a hydraulic interlock will interfere during forward driving from a speed of approx. 10 km/h (6 miles/h) upwards and will make shifting into reverse impossible.

Selector lever in position "0" = Idling and starting position

In this selector lever position there is no positive connection between engine and rear axle. The vehicle can be moved freely (for example, for towing) when the brakes are released.

Do not place selector lever in position "0" at speeds above 30 miles/h (50 km/h)

Similar to selector lever position "P" the engine can be started, while in lever position R, 4, 3 and 2 the electric circuit of the starting motor is interrupted by a starter locking switch.

Selector lever in position "4" = Normal driving

In this selector lever position all 4 forward speeds are automatically successively shifted. In almost all driving conditions position "4" provides optimal driving conditions and is therefore normally used for all drives in the country and in the city. Contrary to the stepless operation of a hydraulic clutch the automatic transmission operates as acted upon by the various control elements such as shift sleeve housing, pressure modulator and pressure step regulator, whose operation depends on the vehicle speed and the position of the accelerator pedal.

By means of the gas pedal the driver is therefore able to influence the moment when shifting should take place. The more he steps on the gas the later will the transmission shift up into the next higher gear. If he releases the gas pedal while the gears run, for example, still in third, the transmission will change up to fourth.

The gas pedal may be moved beyond its full throttle position, which is identified by a pressure point, into an additional kickdown position. In this kickdown position changing-up to the next following gear takes place only at the limit or maximum speed of the respective gear; vice-versa for faster acceleration, shifting-down may be accomplished during normal driving by moving the gas pedal to kickdown position.

Selector lever position "4"

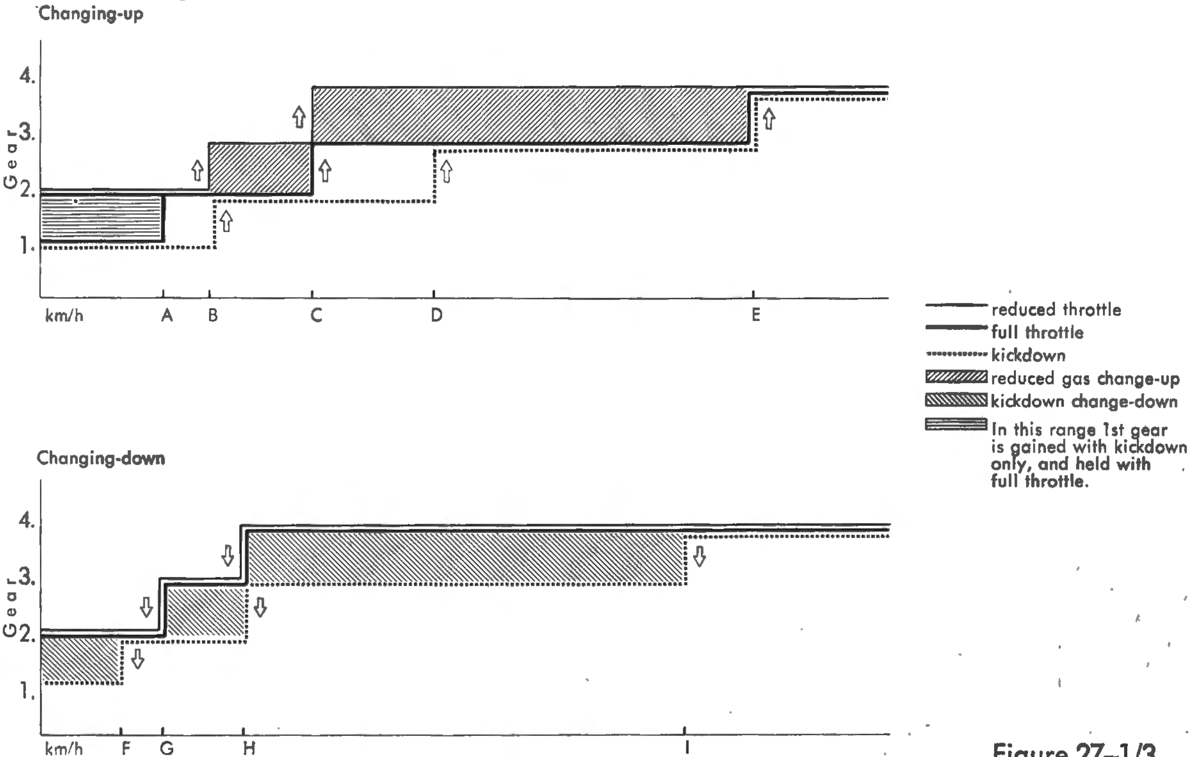


Figure 27–1/3

For speed values see Table Job No. 27–0.

Changing-up

with reduced throttle

If with the vehicle stopped the selector lever is shifted to position "4", the transmission will be in 2nd gear. In reduced throttle position changing-up from 2 to 3 takes place at the earliest at "B" at the latest at "C", changing-up from 3 to 4 at the earliest at "C", at the latest at "E". Please note that the term reduced throttle means the range between idling and full throttle.

at full throttle
Full throttle also starts in 2nd gear. Changing-up from 2 to 3 takes place at "C", changing-up from 3 to 4 at "E".

at kickdown
Kickdown position of the gas pedal permits energetic acceleration because the transmission changes down to 1st gear when starting or below "F". Following this change-down operation at kickdown first gear may be held while applying full throttle.

Changing-up from 1 to 2 takes place at full throttle at "A" and at kickdown at "B", changing-up from 2 to 3 at kickdown at "D", and changing-up from 3 to 4 at full throttle and kickdown at "E". This shows that at kickdown position the 2nd gear may be run up higher than at reduced or full throttle (except with transmission type 1 in which full throttle and kickdown have the same effect).

Changing-down
To prevent shift fluctuations from low into high and vice-versa the hydraulic gear-changing system is set up in such a manner that changing-down takes place at lower speed than changing-up.

at reduced throttle.
Changing-down from 4 to 3 takes place at "H", changing-down from 3 to 2 at "G". Changing-down from 2 to 1 is impossible at reduced throttle.

at full throttle
Changing-down from 4 to 3 at "H",
changing-down from 3 to 2 at "G",
changing-down from 2 to 1 is also impossible at full throttle.

at kickdown
Changing-down from 4 to 3 takes place below "J", changing-down from 3 to 2 below "H" and changing-down from 2 to 1 below "F".

Selector lever in position "3" = Driving on average grades and slopes
Selector lever position "3"

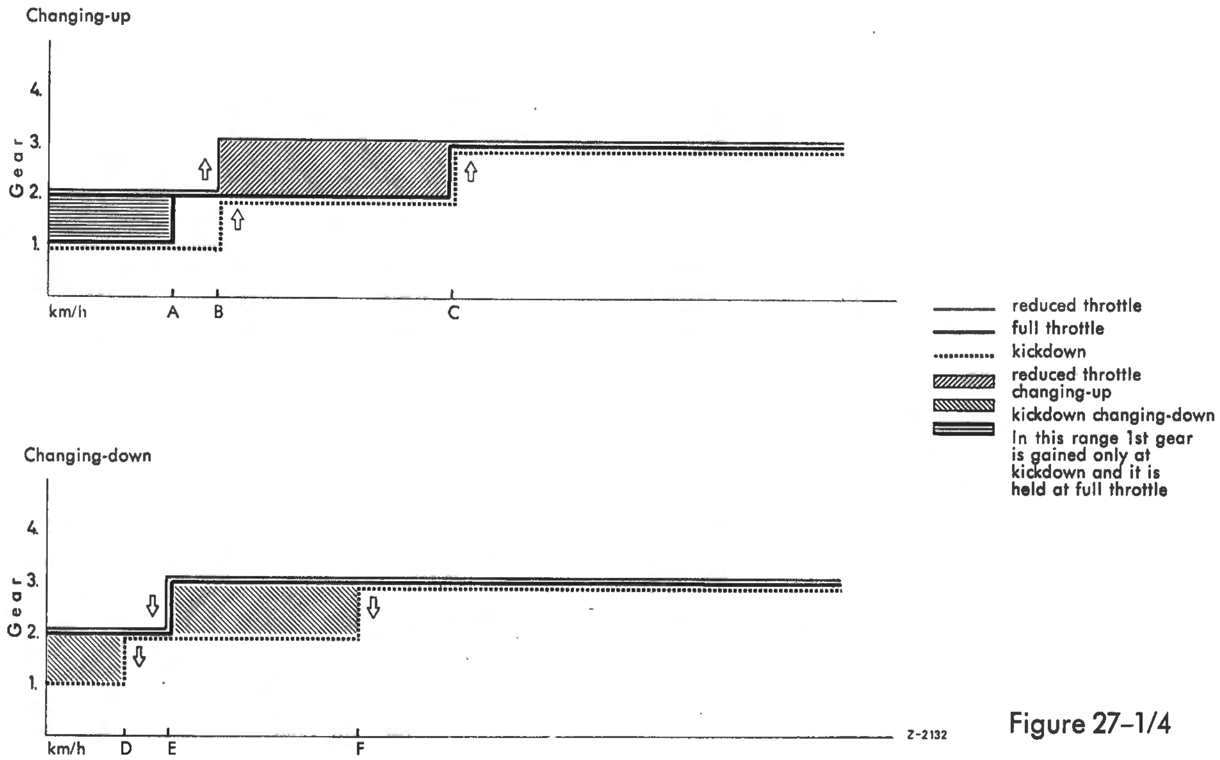


Figure 27–1/4

For speed values see Table Job No. 27–0.

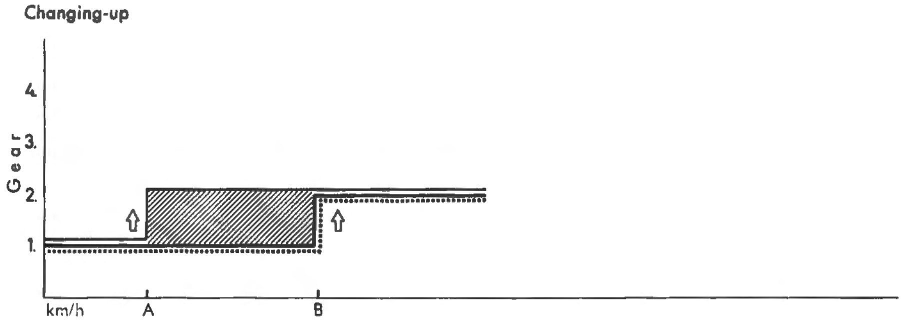
In this selector lever position 4th gear is no longer available. The 3rd gear may therefore be used as braking gear. In this selector lever position "3" starting takes place in 2nd gear at reduced throttle and full throttle.

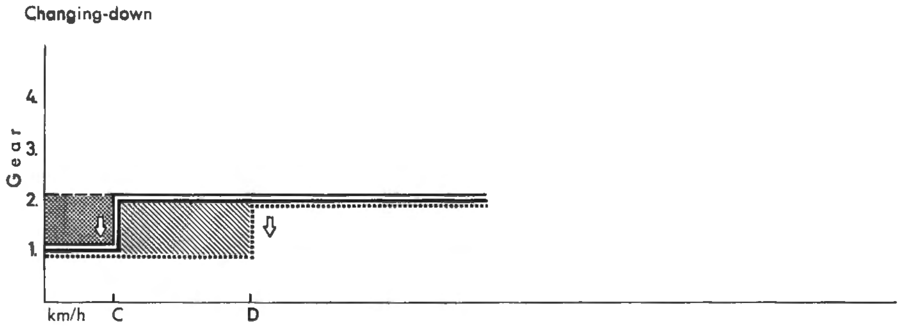
The speed limit of 2nd gear at full throttle has been raised to "C". Changing-down from 3 to 2 at kickdown takes place below "F". For the rest the operational effect is similar to selector lever position "4". To prevent overrevving of the engine 3rd gear in this selector lever position should be held only up to the permissible maximum speed (see Table in Job No. 27–0). Therefore, the selector lever should be shifted from position "3" to position "4" at this speed at the latest.

Corresponding to this restriction, engine brake engagement by shifting the selector lever from position "4" to "3" should be effected only at speeds below the permissible maximum speed (see Job No. 27–0).

Selector lever in position "2" = Driving on steep mountain passes, in convoy with repeated starting, and with trailer in the mountains

Selector lever position "2"





reduced throttle
full throttle
kickdown
reduced throttle changing-up
kickdown changing-down
In this range idling speed position of gas pedal will hold 2nd gear.

Figure 27–1/5

For speed values see Table Job No. 27–0.

In selector lever position "2" the transmission will change-up only up to 2nd gear. 3rd and 4th gear are not available. Therefore this selector lever position is mainly meant for engine brake applications and driving across mountains. For starting, contrary to selector lever position "4" and "3" for all gas pedal positions (reduced throttle, full throttle and kickdown), only 1st gear is available. At reduced throttle the transmission shifts at the earliest at "A", at the latest at "B" into 2nd gear. The speed limit of 1st gear at full throttle and kickdown has been raised to "B". Changing-down from 2 to 1 takes place at reduced throttle and full throttle at "C", at kickdown below "D". But the transmission does not change-down to 1st gear when the vehicle is coasting to a stop or is braked at idling position of gas pedal.

To prevent overrevving of the engine the permissible maximum speed must not be exceeded in position "2". Engine brake engagement from position "3" or "4" to position "2" should be attempted only when the speed is below the maximum prescribed for position "2" (see Table in Job No. 27–0).

c) Driving Instructions

During normal driving conditions both in the country and in city traffic the selector lever should be shifted to position "4". When shifting the selector lever from position "0" or "P" into one of the driving positions the foot brake should be operated because a slight cutting-in bump is unavoidable. This cutting-in bump depends on the speed of the idling gear. **Therefore, when shifting the selector lever into a driving position, never operate the gas pedal; likewise with gear engaged and brake actuated, don't play around with gas pedal.**

During city driving be sure that the brake is actuated when short stops (at traffic lights and road crossings) are the rule and when the selector lever is left in driving position (vehicle creep).

For slow manoeuvring while parking the engine is suitably held to a speed suiting the occasion by stepping on the gas pedal with the right foot, while inching the vehicle along by more or less heavy braking with the left foot.

If the vehicle is stuck in soft ground periodic to and fro movements of the selector lever between position "R" and one of the forward driving positions will rock the car into solid footing. Accelerate slightly for this purpose.

d) Emergency Start of Vehicle (Towing of Vehicle)

If for some reason or other the engine cannot be started with the starting motor start as is customary in such a case by having the vehicle towed or by coasting down a slope. For this purpose shift selector lever first to position "0", then switch on the ignition and at a driving speed of approx. 19 miles/h shift selector lever to position "3" or "4". While shifting the selector lever from position "0" to position "3" or "4" the gas pedal should be at reduced throttle.

If the engine is not operated by the rear wheels after engaging a gear, the indication is that the secondary pump cannot yet meet the oil requirements of the transmission. Take selector lever **immediately** back to position "0" and then once again to position "4" or "3" after another minute of towing.

If the vehicle is towed be sure to use a long towing rope and shift selector lever immediately to position "0" the moment the engine is starting up, in order to prevent hitting the towing vehicle.

e) Towing of Vehicle

If the vehicle must be towed for some reason or other shift selector lever into position "0". **Towing speed should not be less than 12 miles/h and should not exceed 31 miles/h. If the towing distance is long, if towing can only be done at a "crawling" speed, or if the transmission itself is damaged make sure that the universal shaft is disconnected at the rear axle.**

Maintenance work

Job No.
27–2

Change: Table on oil capacities added

With the engine running, work must only be carried out with the selector lever in position "P" and the handbrake firmly pulled.

During oil level checks and when refilling oil, most careful cleanliness must be adhered to; even the most minute impurity (for instance, fluff) may lead to trouble.

A. Oil level check

Too little oil, as well as too much oil will impair the perfect function of the transmission. Therefore check the oil level **regularly** with the transmission oil dipstick stored in engine compartment.

Check oil level with the engine running, handbrake pulled, selector lever in position "P", with the **vehicle standing on level ground** and **transmission at operating temperature** (approx. 80° C cooling water temperature). Prior to checking, let engine run approx. 1–2 minutes at idling, to permit the hydraulic clutch to fill up.

Measuring:

Pull out oil dipstick, wipe off with a rag free of fuzz (leather, if possible), dip in completely for measuring, pull out again and read off oil level.

Correct oil level:

With the transmission at operating temperature, the correct oil level must be **between the upper and lower dipstick mark.** Too much oil is filled in if the oil level is above the upper mark, too little oil if the oil level is below the lower mark.

Use only specified automatic transmission fluids.

Special instructions:

Fill in lacking oil quantity through a funnel with fine screen **into pipe for oil dipstick** while the engine is running. (We recommend our funnel 111 589 04 63 00.) Use as reference value: Distance between the upper and lower dipstick mark corresponds to approx. 0.5 ltr. transmission oil.

Watch out for most careful cleanliness.

Due to heat expansion of transmission housing and transmission oil, check oil level only while the transmission is warm. A completely **cooled-down transmission** will indicate an **oil level below the lower dipstick mark** even if it contains the correct oil capacity.

With too **low oil level, air is sucked in** by the oil pump which is clearly audible. The **oil develops foam** which will lead to a **faulty result** when checking the oil level. Shut off engine until oil is de-foamed (approx. 2 minutes), top up with oil and check oil level.

Be sure to drain excessive transmission oil or suck off, because otherwise the transmission gear set has to overcome unnecessary resistance. The temperature rises unpermissibly until the foamy oil is ejected to the breather. The **transmission would be damaged** after **longer operation.**
Sprayer 112 589 03 72 00 for flushing the oil cooler is suitable for sucking off too much transmission oil when provided with a hose.

When after filling in oil the upper dipstick mark is reached, operate foot brake, set selector lever into positions R–0–4–0–R (leave in each position for a few seconds) and set again to position "P", so that the work pistons of the servo members are coated with oil. Then check oil level again and correct, if required.

B. Oil change

Watch out for the following conditions while changing oil: set vehicle to level ground, transmission at operating temperature, engine shut off.

First remove oil drain plug on transmission and drain oil (Fig. 27–2/1).

Fig. 27–2/1

Then remove cover at bottom of clutch housing by loosening bolts and rotate hydraulic clutch on crankshaft until oil drain plug (1) becomes visible and can be screwed out (Fig. 27–2/2).

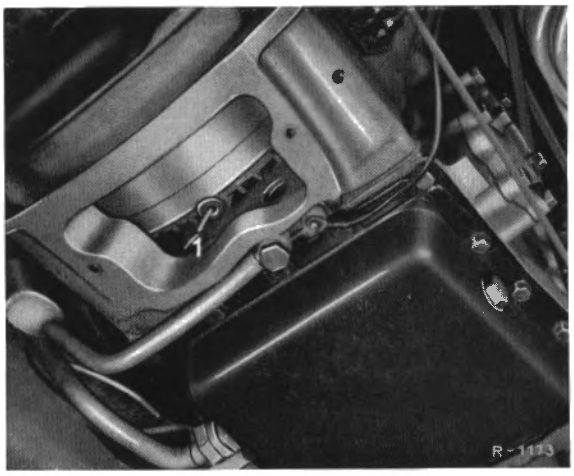


Fig. 27–2/2

1 Clutch oil drain plug

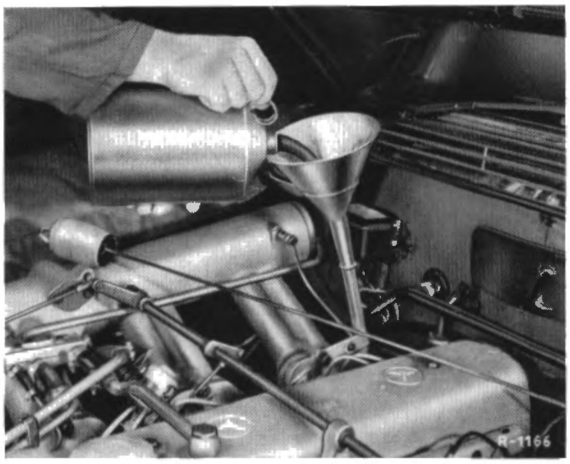


Fig. 27–2/3

When no more oil comes out from transmission and clutch, screw in both drain plugs and reattach clutch housing cover.

Attach drain plugs with new sealing rings.

Hydraulic clutch: sealing ring A 12 × 18 DIN 7603 Al 99 F 8
Oil pan: sealing ring A 14 × 18 DIN 7603 Al 99 F 8

Oil capacities

Vehicle models	Oil capacities in liters		Remarks
	for new installations	for oil changes	
190 c, 190 Dc 200, 200 D, 230	$4^1/_2$	$3^1/_2$	without oil cooler
220 b, Sb, SEb 230 S, 230 SL 250 S, 250 SE	$4^3/_4$	$3^3/_4$	with oil cooler
300 SE, 300 SEb, 300 SEL	$5^3/_4$	$4^3/_4$	

At first, fill in a larger quantity of one of the automatic transmission fluids specified by us (refer to specifications for fuels, lubricants and coolants) through the hole for the dipstick while the engine is stopped (all models except model 300 SE: approx. 3 liters, model 300 SE: approx. 4 liters). Start engine and let run at idling in selector lever position "P". Subsequently fill in approx. $^3/_4$ liter of oil slowly (Fig. 27–2/3). Then check oil level with warm oil at operating temperature.

Directly after filling-in, the oil level with correct oil quantity is approx. at the lower dipstick mark. (With warm oil, the oil level reaches the upper mark.)

We recommend to drive at partial throttle after oil changes for about 660 ft. and to check the oil level again. It should be at the lower mark. (Cold transmission oil.)

C. Maintenance instructions

The routine customer service work and oil change intervals are listed in the table below:

Work	After the first 500 km at Chart A	Regulary every	
		5,000 km [1]	20,000 km at Chart E
Oil level check	×	×	—
Retightening bolts on oil pan of transmission (for tightening torque refer to job No. 27–0)	×	—	—
Checking shift and kickdown linkage adjustment (refer to job No. 27–4)	×	—	×
Oil change	—	—	×[2]

[1]) and prior to every major long-distance trip and at each engine oil check.

[2]) however, at the latest after one year.

Removing and installing the transmission

Job No.
27–3

Change: Deviations of installation work on new models added (marked with)*

A. General

Due to its slightly higher weight, the automatic transmission can only be removed and installed by means of a pit lift or lifting jack which must be provided with a special attachment (Fig. 27–3/1).

This attachment is required to obtain a perfect, untilting support for the transmission. The upper plate of the attachment is resiliently held on the base plate by springs so that the transmission can be moved for convenient removal and installation.

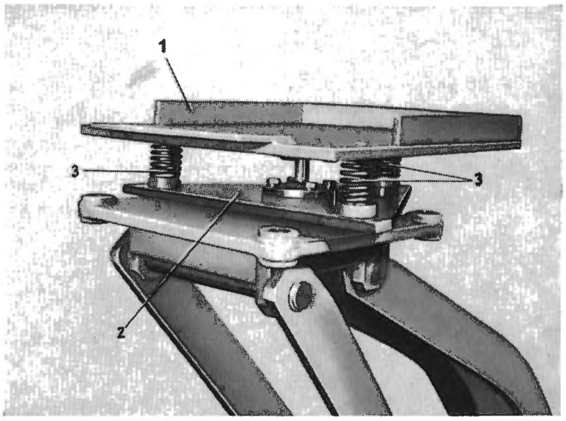


Fig. 27–3/1

1 Support plate 2 Base plate 3 Compression springs

The attachment BE 11 857 can be mounted on any suitable transmission or car lifting jack with slight changes. If it is not supplied as shop equipment by the company, the drawing No. BE 11 857 for making the attachment at your end can be submitted by the dept. Zentral-Planung/Einrichtungen Niederlassungen.

If the special attachments for automatic transmissions are available abroad by the leading companies of the American accessories industry, these can be used after respective changes.

Jack vehicle up at front and rear for pulling out the transmission towards the front or laterally by means of the car or transmission lifting jack. (On model 300 SE, pull out knob for valve unit of air suspension completely.) The dimension from the ground to bottom edge of lifting jack support must be 63–65 cm in this case.

*The following paragraphs describe the removal and installation of the automatic transmission on model 220 SEb. The installation work is carried out in the same way on all other models. However, observe the following differences: Model 300 SE has a larger hydraulic clutch and housing, as well as no flywheel on engine. At the place of the flywheel, a carrier plate of sheet metal is mounted which is attached on the hydraulic clutch by **6 hexagon bolts.**

*On models 200 and 200 D, the hydraulic clutch is mounted by means of 3 times 2 hexagon bolts on the flywheel. There is no trunnion screw on the hydraulic clutch so that there is no definite alignment between flywheel and clutch.
Models 190 c, 190 Dc, 200, 200 D and 230 have no oil cooler.

***Remove radiator prior to replacing a damaged automatic transmission (job No. 50–1). – Flush transmission oil cooler in bottom water box thoroughly with sprayer 112 589 03 72 00, using wash gasoline or kerosene. While replacing the transmission, place oil cooler in vertical position to permit draining and drying up until it is re-installed. (Does not apply for models 190 c, 190 Dc, 200, 200 D, 230.)**

The hydraulic clutch cannot be flushed with standard workshop equipment and must therefore be replaced when the transmission is damaged.

In addition, carefully clean all hydraulic lines which can be re-used for the new automatic transmission.

B. Removal and Installation

Removal:

1. Disconnect minus cable from battery.
2. Drain transmission oil. For the purpose, screw off oil drain plug on oil pan of transmission and on hydraulic clutch (Fig. 27–3/2 and 3).

   Use clean vessel only!
   (Refer also to job No. 27–2, section B.)

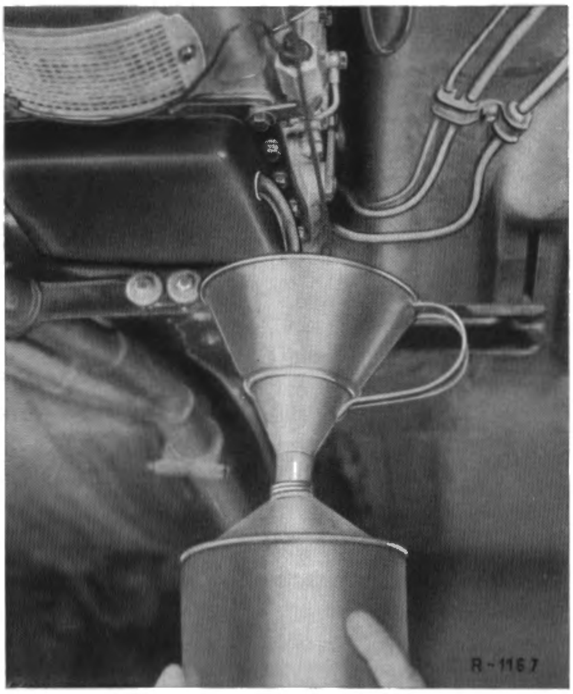


Fig. 27–3/2

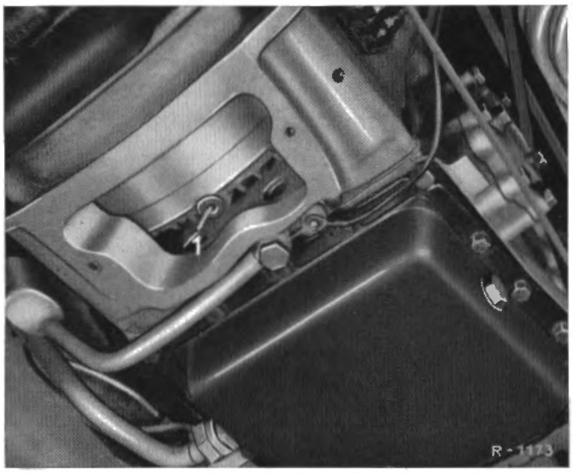


Fig. 27–3/3
1 Clutch oil drain plug

3. Separate feed line (1) and return line (2) for oil cooler from connecting lines (4) (Fig.) 27–3/4).

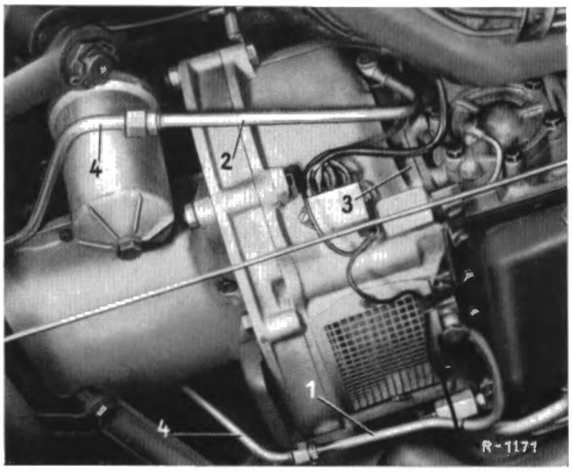


Fig. 27–3/4
1 Feed line to oil cooler
2 Return line from oil cooler
3 Front transmission housing cover
4 Connecting line

4. Remove guard plate (1) for modulating pressure transmitter (Fig. 27–3/5).

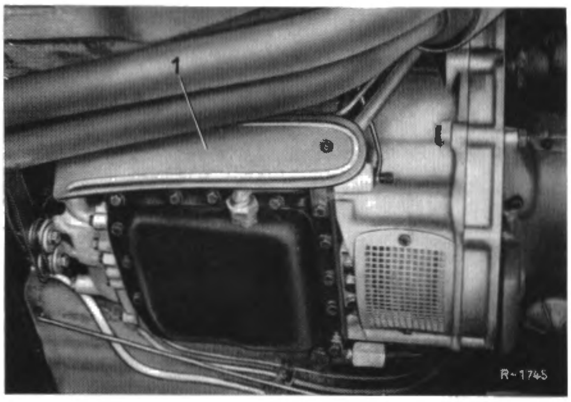


Fig. 27–3/5
1 Guard plate

5. Unscrew underpressure line (1) from modulating pressure transmitter and oil filler pipe (2) from oil pan (Fig. 27–3/6).

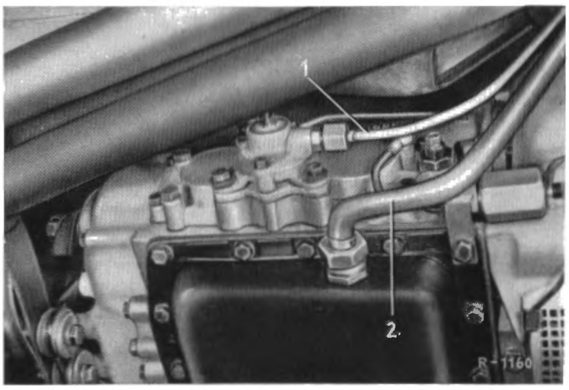


Fig. 27–3/6
1 Underpressure line 2 Oil filler pipe

6. Disconnect hand brake cable from brake lever and pull out of ducts.

7. Remove guard plate (3) for junction block (4). Unscrew electric lines from cable connection, disconnect electric line (1) from oil pressure switch (2) (Fig. 27–3/7).

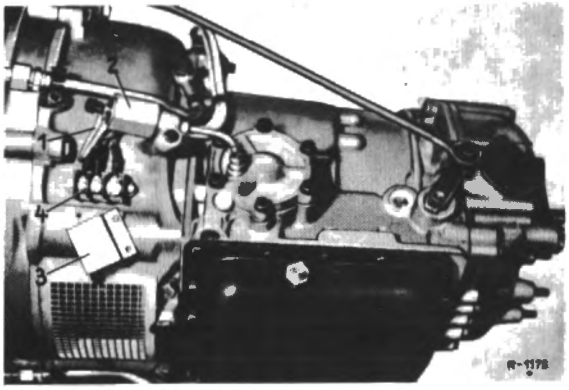


Fig. 27–3/7

1 Electric line
2 Oil pressure switch
3 Guard plate
4 Junction block

Fig. 27–3/7 shows the 2nd type of oil pressure switch arrangement and wiring. All other illustrations show the 1st type.

8. Disconnect speedometer cable (3) from transmission (Fig. 27–3/8).

9. To disconnect selector rod (4) on transmission, place selector lever in position "2" (Fig. 27–3/8).

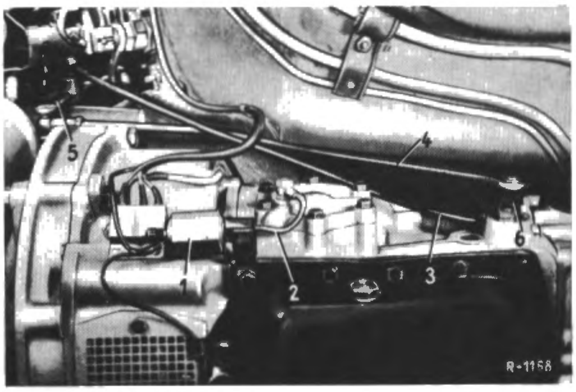


Fig. 27–3/8

1 Oil pressure switch
2 Pressure line
3 Speedometer cable
4 Selector rod
5 Intermediate lever
6 Range selector lever

Remove wire lock on ball socket and remove selector rod from intermediate lever (5). Then press off selector rod from range selector lever by means of a screw driver (Fig. 27–3/9).

Fig. 27–3/9

10. Remove bracket for front exhaust pipe (1). Remove rubber bearings (2) from rear engine support (3). Remove rear engine support (3) (Fig. 27–3/10).

Prior to removal of the rear engine support, the engine must be supported at oil pan. Place suitable piece of wood between engine oil pan and front axle carrier (Fig. 27–3/11).

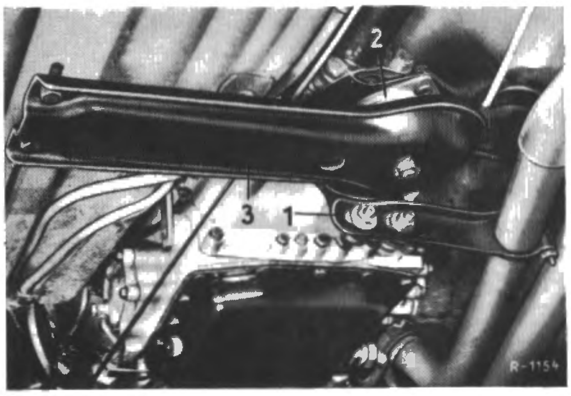


Fig. 27–3/10

1 Bracket for front exhaust pipe
2 Rubber bearing
3 Rear engine support

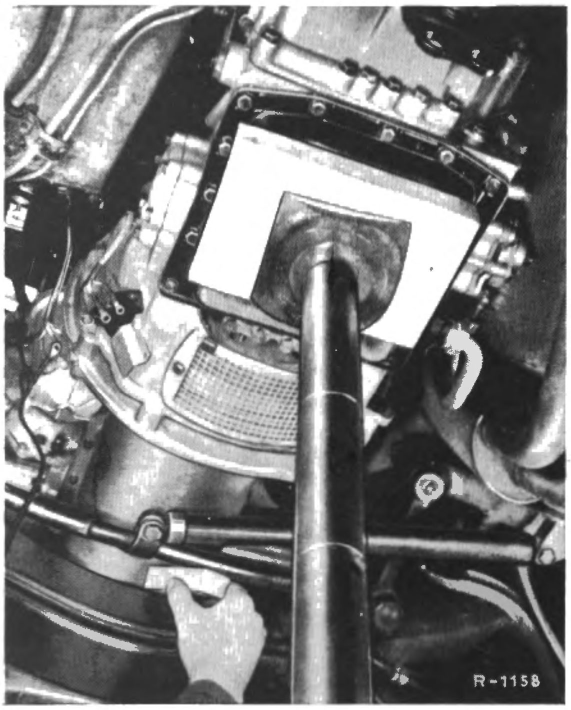


Fig. 27–3/11

11. Remove engine support from rear transmission cover. Disconnect propellor shaft. Loosen and slide back propellor shaft intermediate bearing support.

12. Remove cover plates from transmission housing. Separate fluid coupling from drive plate or flywheel. For this purpose, unscrew 4 allen head screws on all models except 300 SE, and 6 hexagonal bolts on model 300 SE (Fig. 27–3/12).

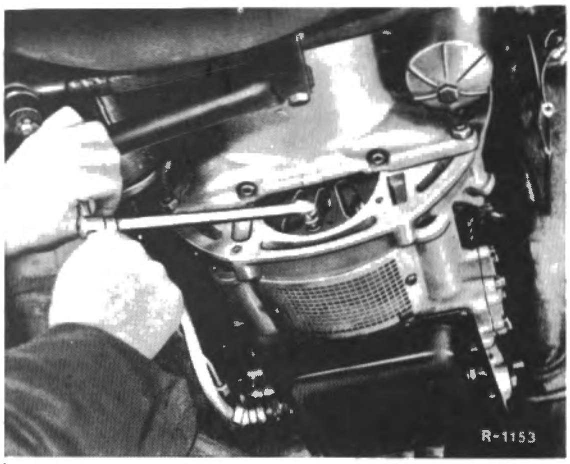


Fig. 27–3/12

13. Remove starter motor attaching bolts.

Note: The top attaching bolt for starting motor may be loosened from inside car through opening in floor pan (Fig. 27–3/13).

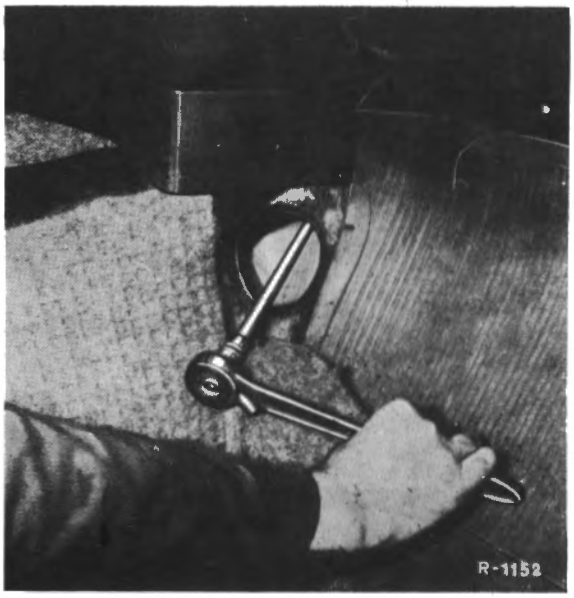


Fig. 27–3/13

14. Remove upper fastening bolts on clutch housing.

Note: Remove fastening bolt at right-hand end from inside vehicle (Fig. 27–3/13). The fastening bolt at left-hand end can be removed only from below car by means of an extended flexible joint wrench.

15. Place vehicle on supporting jacks (Fig. 27–3/14).

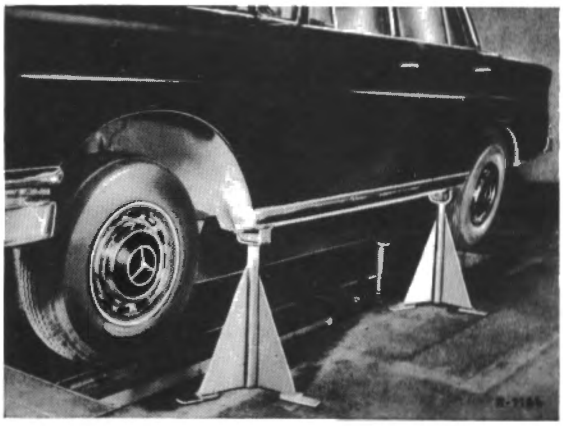


Fig. 27–3/14

16. Cover pit. Slide car jack with transmission supporting top under the vehicle in such a manner that the transmission is supported at oil pan (Fig. 27–3/15).

17. Remove bottom fastening bolts on clutch housing (Fig. 27–3/15).

Fig. 27–3/15

18. Push transmission with fluid coupling toward rear axle so that the bearing pin of the fluid coupling no longer touches the intermediate flange during the lowering.

19. Carefully lower car jack and transmission and fluid coupling. Pull jack out toward front (Fig. 27–3/16).

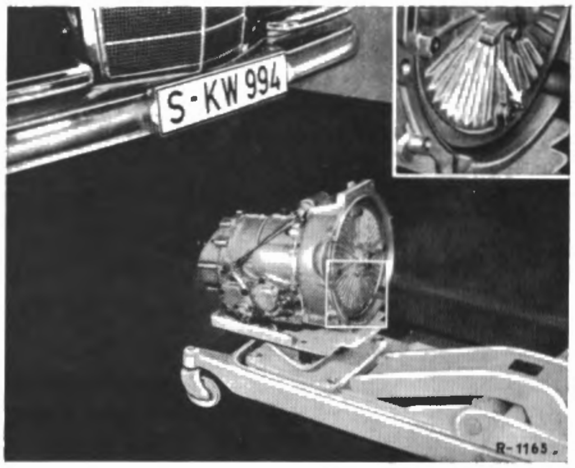


Fig. 27–3/16

20. Remove fluid coupling. For this purpose, screw two M 8 holding bolts into primary rotor. Support transmission vertically and carefully pull out coupling upwardly (Fig. 27–3/17).

Fig. 27–3/17

Installation:

21. Install fluid coupling. For this purpose, screw two M 8 holding bolts into clutch. Set transmission in vertical position and carefully place clutch on drive shaft (Fig. 27–3/17).

    Prior to installation, observe position of pump gear of primary pump. The drive fingers on the hollow shaft (1) should have the same position of engagement as the pump gear. Move clutch slightly during installation in order to insert drive shaft splines into secondary member of fluid coupling (Fig. 27–3/18).

    Also make sure that during installation of the clutch the sealing lip of radial sealing ring in the primary pump housing is not damaged. The properly assembled clutch will touch the clutch housing with its cooling fins (sliding noises during turning). With transmission installed the clutch is supported and can no longer slide on the clutch housing.

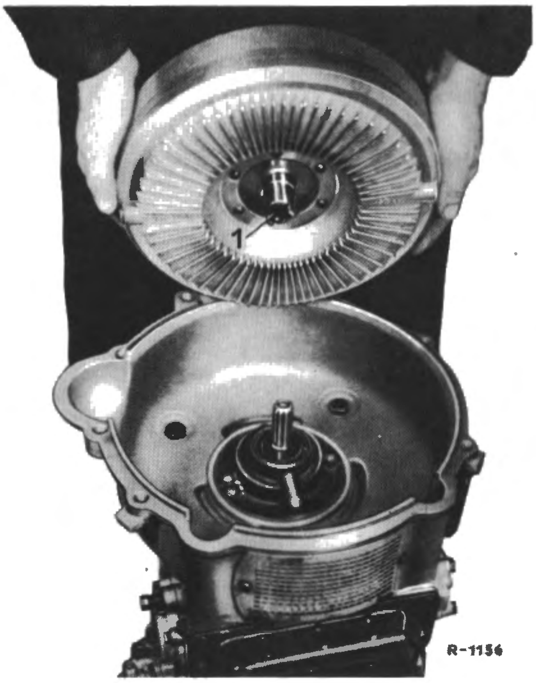


Fig. 27–3/18

1 Hollow shaft

22. Place transmission on car jack. Rotate coupling in such a manner that locating screw points downward (refer to arrow in Fig. 27–3/16).

23. Rotate engine until hole (1) in carrier plate (2) for locating screw of coupling is at bottom (Fig. 27–3/19).

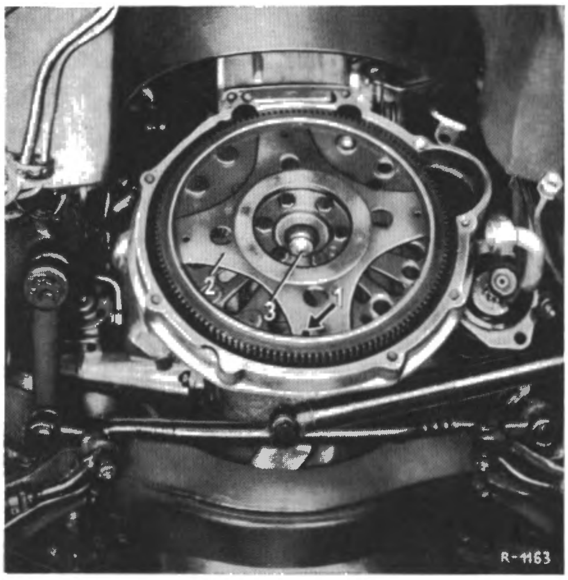


Fig. 27–3/19

1 Hole for locating screw
2 Carrier plate
3 Bearing for coupling

24. Move transmission into place and raise by means of car jack to the point where the lower screw holes of clutch housing align with holes in intermediate flange and locating screw in coupling is in front of carrier plate hole. Push transmission forward until clutch housing abuts fully (Fig. 27–3/20).

Note: Do not use force; check whether locating screw is located in guide.

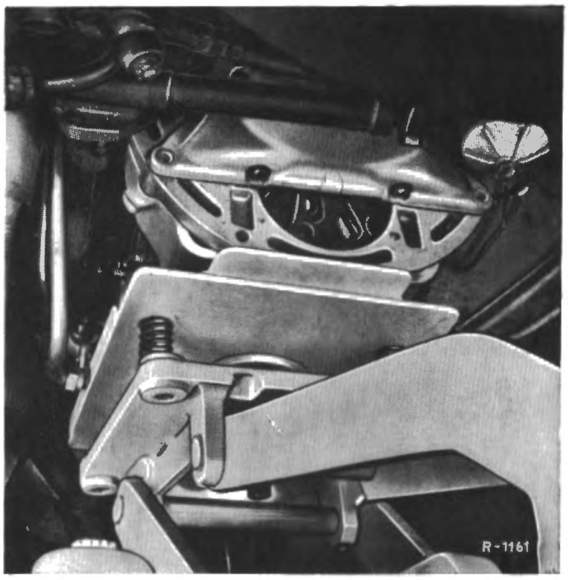


Fig. 27–3/20

25. Attach transmission with bottom and top fastening bolts. Tighten top right-hand bolt through transmission tunnel and top left-hand bolt from pit by using an extended flexible joint wrench.

Note: Car jack may be let down only when engine is supported at oil pan (refer to item 10).

26. Insert allen head screws or hexagon screws with corrugated lock washers into primary rotor of coupling and tighten with torque specified in Job No. 27–0 (Fig. 27–3/21). Assemble cover plates for clutch housing.

27. Remount starting motor.

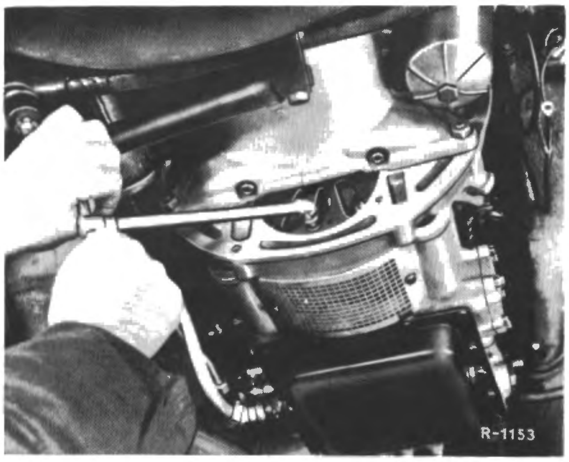


Fig. 27–3/21

28. Reconnect propellor shaft. Fasten engine support to rear gear housing cover and install bracket for front exhaust pipe and rear engine support.

29. Raise transmission slightly with pit lift or car jack and remove wooden block supporting engine (Fig. 27–3/22).

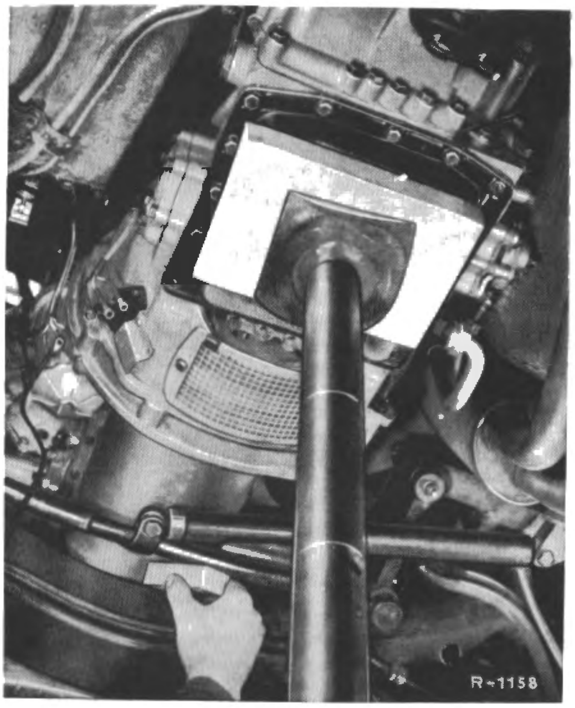


Fig. 27–3/22

30. Attach rubber support to rear engine support.

31. Take vehicle from jacks.

32. Reinstall selector rod. For this purpose, place shift lever (6) and selector lever in position "0". Press selector rod (4) by means of suitable screwdriver to bearing pin of shift lever (6) (Fig. 27–3/23 and 24). Adjust selector rod lengthwise until ball cup is aligned with ball head on intermediate lever (5) (Fig. 27–3/24). Attach selector rod to intermediate lever and install wire lock. Tighten counter nut.

Note: The smaller diameter of plastic bearing in selector rod should always be at transmission end.

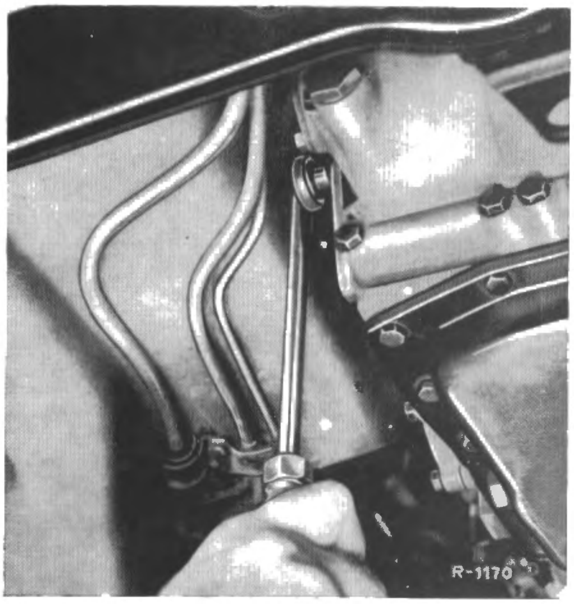


Fig. 27–3/23

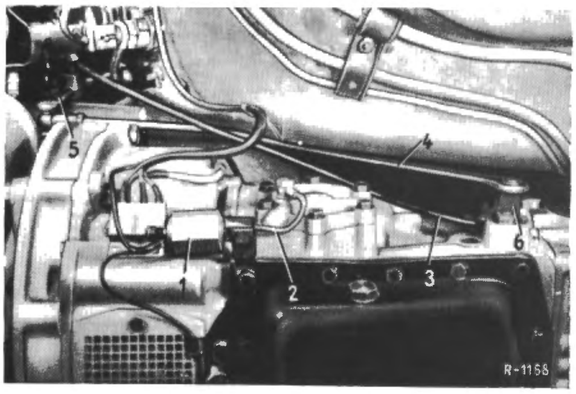


Fig. 27–3/24

1 Oil pressure switch
2 Pressure line
3 Speedometer cable
4 Selector rod
5 Intermediate lever
6 Shift lever

33. For completion of transmission assembly proceed in reverse through the disassembly steps, items 1 to 8.

C. Preparing Replacement Transmissions for Installation

Transmissions as supplied (without clutch housing, lines, etc.) cannot be installed immediately, but require preparation prior to assembly. The parts required for this purpose (Fig. 27—3/25 and 26) are disassembled from the transmission about to be replaced. The pipe lines and oil pressure switches are then carefully cleaned or flushed and dried (do not use compressed air for cleaning oil pressure switch). The are then attached to the exchange transmission. Be sure to use new aluminum sealing rings when fitting pipe lines.

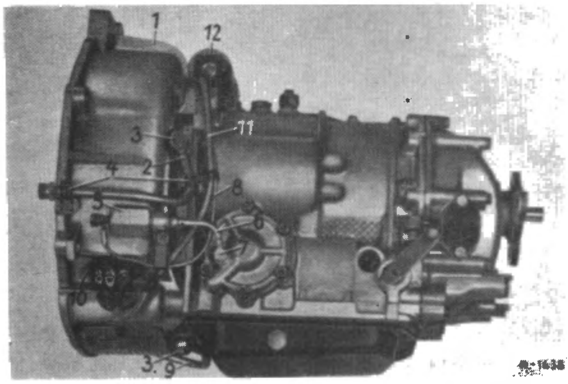


Fig. 27–3/25

Attention: The double-acting solenoid (12) has been tested and set to its various positions on the transmission test bench. For this reason, the attachment should definitely not be loosened, for example, when inserting the connecting cable of the oil pressure switch (8). If required, the clutch housing (1) should be removed again.

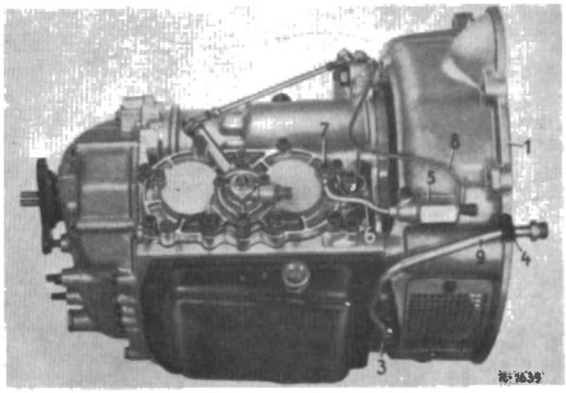


Fig. 27–3/26

1 Clutch housing
2 Return line from oil cooler
3 Hollow screw C 6 DIN 7623
Sealing ring A 12 x 16 DIN 7603 Al 99 F 8
(2 each per hollow screw)
4 Holding clip
5 Oil pressure switch
Sealing ring A 12 x 16 DIN 7603 Al 99 F 8
6 Oil pressure line
7 Hollow screw 112 990 02 63
Sealing ring A 8 x 12 DIN 7603 Al 99 F 8
(2 each per hollow screw)
8 Connecting cable (oil pressure switch)
9 Feed line to oil cooler
10 Cable adapter [1] with cover plate
11 Cable set (double-acting solenoid)
12 Double-acting solenoid

Sequence of preparation:

1. Connecting cable (8) and clutch housing (1).
2. Oil pressure switch (5) with oil pressure lines (6).
3. Oil cooler lines (2) and (9).
4. Retaining clip (4).
5. Cable adaptor (10). (Attach cover plate only after installation of transmission.)

Note: Oil pressure switches (5) with connecting cable (8) are present only in transmissions used for vehicles with injection engines.

[1] Connections:
Front (small screw): kickdown (grounding wire)
center: lift end (grounding line)
rear (large screw): positive wire

Adjusting Work

Job No. 27–4

Change: Adjustment of additional lever with Fig. 27-4/1 added.

Caution: All adjusting work on the automatic transmission, which is listed in the following, must only be carried out when the front and rear axle is loaded by the vehicle's own weight; that is, the vehicle must stand on its wheels and should not be raised by supporting chocks, lifting jacks, etc.

a) Adjusting the shift rod and starter lock switch (steering wheel shift)

Remove shift rod (7), set range selector lever (8) on transmission and selector lever to "0". Push shift rod (7) by a screwdriver on bearing pin of range selector lever (8). Adjust shift rod so that ball socket coincides with ball head on intermediate lever (3). Suspend shift rod on intermediate lever and lock by a wire lock. Tighten counter nut (Fig. 27–4/1).

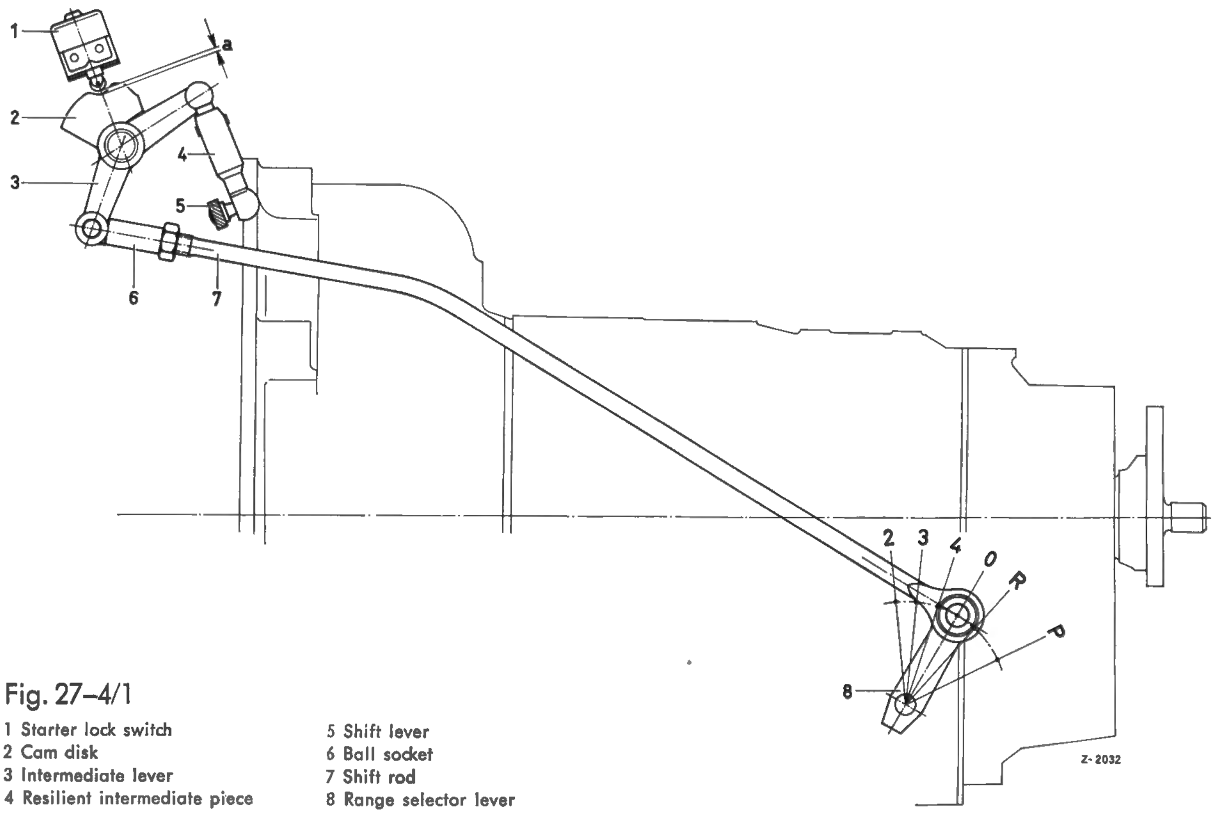


Fig. 27–4/1

1 Starter lock switch
2 Cam disk
3 Intermediate lever
4 Resilient intermediate piece
5 Shift lever
6 Ball socket
7 Shift rod
8 Range selector lever

The shift plunger of starter lock switch (1) should—with a clearance of "a"—always engage one recess of the cam disk (2) in the respective selector lever positions "0" and "P" so that the action of the starter lock is eliminated (Fig. 27–4/1). For dimension "a" refer to job No. 27–0.

Set selector lever to "0". Loosen fastening plate with starter lock switch so far that horizontal shifting is possible. (The fastening plate is provided with an oblong hole and is laterally adjustable, but not in height.) For setting the shift plunger of lock switch which is not visible from above, to center of recess on cam disk, hold a cylinder inspection lamp with mirror behind switch. After adjusting the lock switch, retighten the fastening plate firmly.

Check: Starter should operate in selector lever positions "0" and "P" and must be locked in driving positions (R, 4, 3, 2).

Caution: Operate brake when checking.

b) Adjusting the shift rod, starter lock switch and reversing light switch (center shift)

Remove shift rod (4). Set range selector lever (6) and selector lever (1) to "0", in doing so make sure that between "0" stop of sleeve and selector lever a play of approx. 1 mm exists. Loosen fastening bolts for additional lever so far that the adjusting mark on its upper oblong hole is aligned with the center line of range selector lever (Fig. 27–4/1 b), tighten fastening bolts. The additional lever on model 230 SL is so adjusted that the center lines of both levers are aligned (Fig. 27–4/1 a). Press shift rod (4) on bearing pin on additional lever (5). Adjust adjusting lug (3) so that it coincides with the bearing pin on selector lever bottom section (2). Fine adjustment is possible on the two oblong holes of additional lever (5), if required. Press shift rod on selector lever bottom section (2) (Fig. 27–4/1 a).

The cable pulls (7) which operate the starter lock and reversing light switch, must be so adjusted that starting of the engine is only possible in selector lever positions "0" and "P". The starter must be locked in all other positions. In addition, the reversing lights should light up in selector lever position "R". If required, adjust on adjusting stop (8) (Fig. 27–4/1 a).

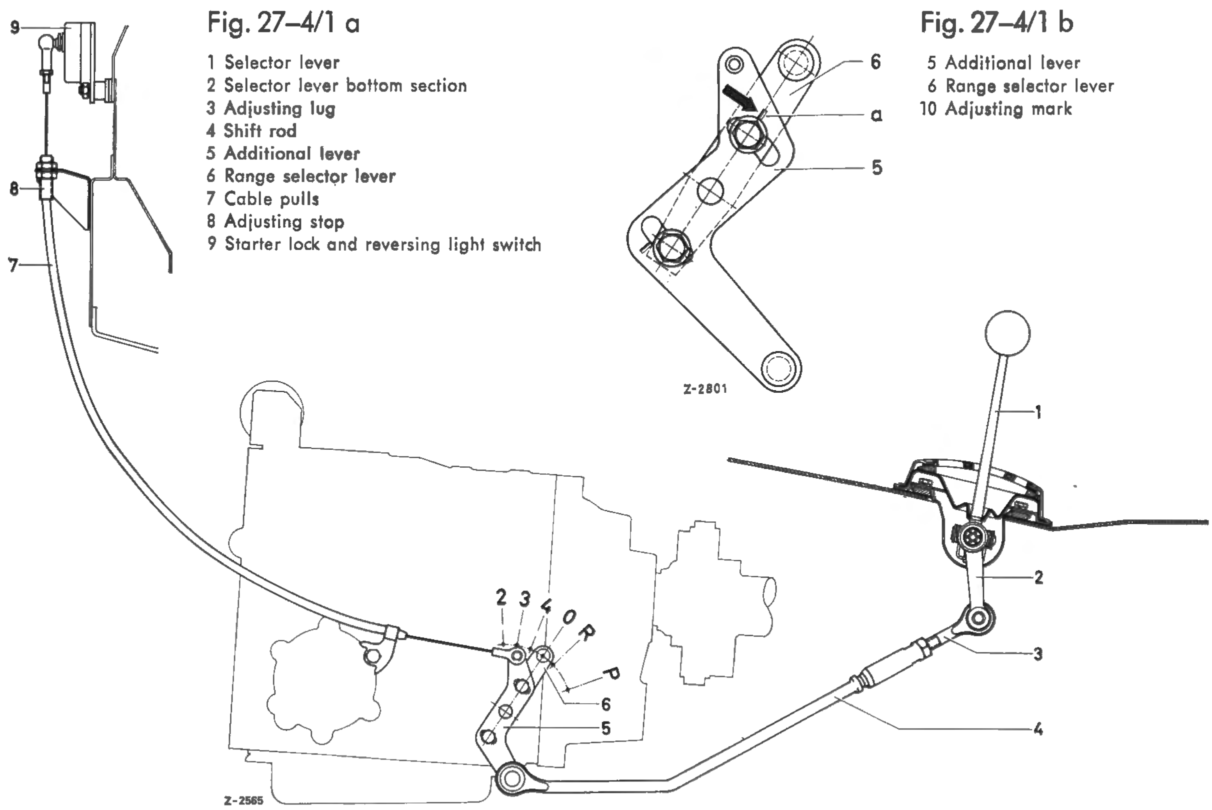


Fig. 27–4/1 a

1 Selector lever
2 Selector lever bottom section
3 Adjusting lug
4 Shift rod
5 Additional lever
6 Range selector lever
7 Cable pulls
8 Adjusting stop
9 Starter lock and reversing light switch

Fig. 27–4/1 b

5 Additional lever
6 Range selector lever
10 Adjusting mark

c) Adjusting the selector lever indication (steering wheel shift)

The selector lever indication is set in selector lever position "0". Cable pulls (3) from shift tube to selector lever indication can be set in length by the knurled nut (4) on selector lever indication (Fig. 27–4/2). For the purpose, loosen counternut (5) and retighten after the adjustment.

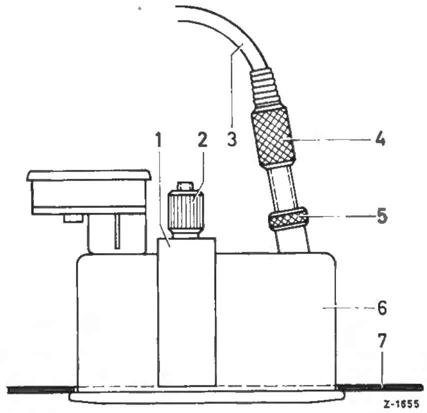


Fig. 27–4/2

1 Clamp
2 Clamp nut
3 Bowden cable
4 Knurled nut
5 Lock nut
6 Housing
7 Instrument panel

d) Adjustment of Kickdown Switch

Screw kickdown switch (4) out of cover plate (2), of the steering column jacket in the direction of the engine compartment, after loosening lock nut (3) (Fig. 27–4/4). Check gas pedal and linkage for easy operation and adjust, if required. The gas pedal should return easily to idling position from both reduced throttle and full throttle.

Screw kickdown switch into the cover plate of the steering column jacket to the point where the throttle valve lever (1) is located approx. 3/16″ from the full load stop screw (2) (Fig. 27–4/3) while the gas pedal rests against the kickdown switch (position B). When the gas pedal is depressed to kickdown (position C), there should still be a play of approx. 3/64″ between throttle valve lever and full load stop on the venturi control unit housing. The adjusting lever of the injection pump, on the other hand, should rest against the full load stop (only for cars with injection engines).

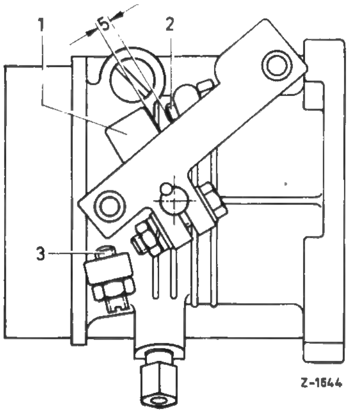
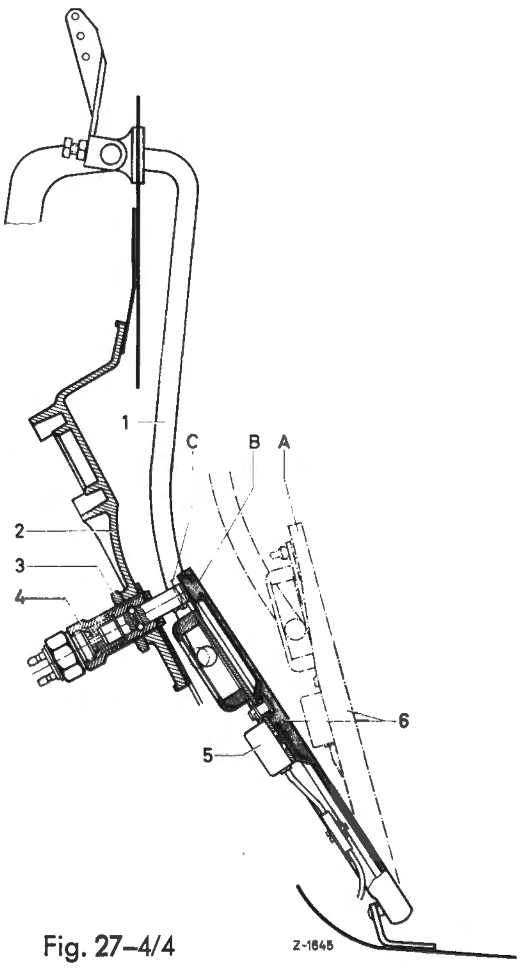
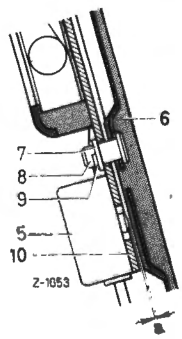


Fig. 27–4/3

1 Throttle valve lever
2 Full load stop
3 Idling load stop





1 Control lever
2 Cover plate
3 Lock nut
4 Kickdown switch
5 Idling switch
6 Foot plate
7 Compensating washer
8 Bolt
9 Cotter pin
10 Plate

A Idling position
B Full throttle position
C Kickdown position

a = .0039 to .0196″ (0.1–0.5 mm)

Fig. 27–4/4

Fig. 27–4/5

e) Adjustment of Kickdown Linkage

When kickdown shifting fails, the kickdown linkage should be checked for proper functioning and the modulating pressure should be checked.

Testing of Kickdown Linkage

For this purpose, operate gas pedal, with ignition switched on and engine stopped, as follows:

With gas pedal not operated (idling position), linkage moves toward the rear.

Gas pedal slightly down (partial to full throttle position), linkage moves to central position.

Gas pedal fully down (kickdown position), linkage moves forward.

If the double-acting solenoid will not move the kickdown linkage into these three positions, there is either an electrical failure (insufficient terminal voltage, short circuit, etc.) or the operating shaft (1) for the modulating pressure control in the brake band piston cover or the modulating pressure control (4) itself is jammed (Fig. 27–4/6).

Measuring of Kickdown Modulating Pressure

For this purpose, connect pressure gauge (84 p.s.i. capacity min.) to test connection (5) (Fig. 27–4/6), disconnect vacuum line from modulating pressure control and run engine at idling speed.

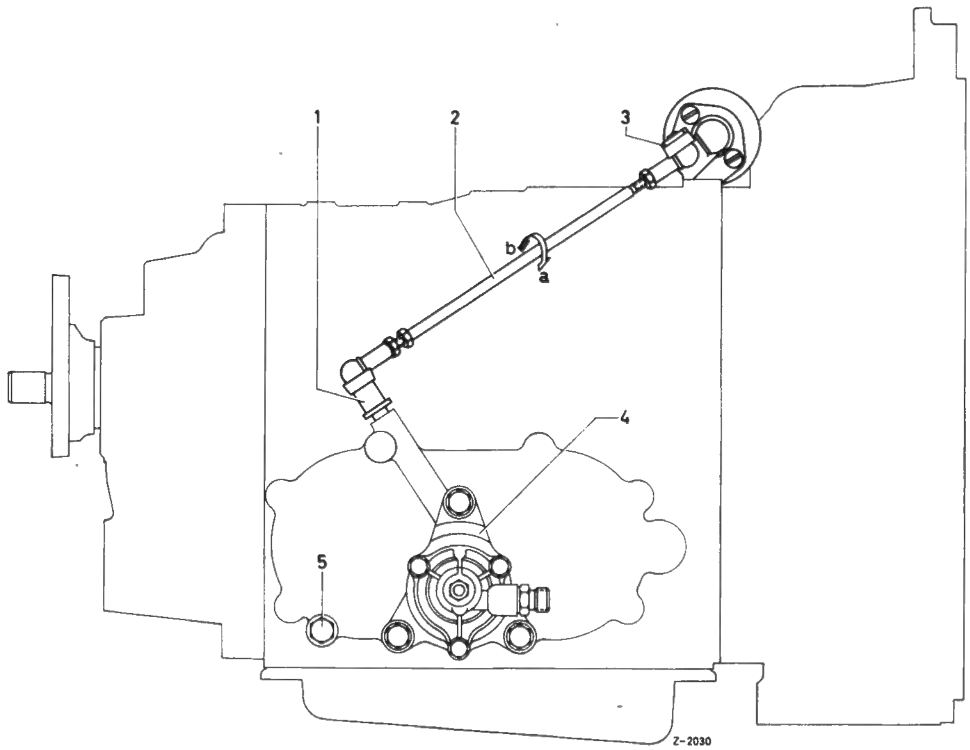


Fig. 27–4/6

1 Operating shaft
2 Linkage
3 Angle lever
4 Modulating pressure control
5 Measuring connection for modulating pressure

Move gas pedal down slightly with right foot while simultaneously operating the kickdown switch with tip of left foot. Read kickdown modulating pressure on pressure gage (for value refer to Job No. 27–0).

If the pressure is too low, either the linkage (2) or the angle lever (3) on the double-acting solenoid may be worn. Check by shaking angle lever (3) of double-acting solenoid when in kickdown position (accessible from passenger compartment through opening in transmission tunnel). If required, remove play or replace angle lever.

Kickdown modulating pressure is adjusted by increasing the length of linkage (2) by turning in direction "a" (reduction of pressure) or in direction "b" (increase of pressure). If the kickdown modulating pressure is adjusted, the basic pressure should also be tested (for values refer to Job No. 27–0); it should never exceed the upper limit.

Note: For general adjustment instructions for modulating pressure see Job No. 27–8, Section D, part a.

f) Adjustment of Idling Switch (rotary switch on throttle valve)

If the idling switch on a venturi control unit or a carburetor has been replaced it must be properly adjusted. The adjustment must be checked when there is trouble in the electrical system of the automatic transmission (e. g. racing of the engine, slipping of servo members, no braking shifts when driving down a grade at more than 1,200 m above sea level). The check can only be done with a revolution counter and a testing light. The idling switch can only be checked or adjusted when the engine is at normal working temperature, i. e. at a minimum cooling water temperature of 80° C.

Note: Disconnect the cables from the idling switch befor warming up the engine.

Checking of Idling Switch

Disconnect the two cables from the idling switch.

Connect one terminal of the idling switch to ground and connect a testing light to the other terminal. Connect the testing light to the positive terminal of the battery.

Apply the hand brake, run the engine at idling speed and move the selector lever into one of the driving positions. The testing light should now be on and should only go out under slight acceleration. (This applies also to engines equipped with a solenoid for constant engine speed.)

Connect the revolution counter to the engine and check the switch-off speed. Move the selector lever to position "0" or "P" and accelerate slowly. Watch the speed increase on the revolution counter: when the switch-off speed (see Job No. 27–0) is reached the testing light must have gone out.

If the testing light has not gone out when the switch-off speed (see Job No. 27–0) is reached, the idling switch must be adjusted.

Adjustment of Idling Switch

Slightly loosen the fixing screws of the idling switch and at an increased idling speed of approx. 1,200 r.p.m. turn idling switch until the testing light goes out.

Tighten the fixing screws and repeat the check.

Note: In injection engines the idling switch is fastened to the throttle valve part with two screws, in carburetor engines with one screw.

g) Adjustment of Control Rod

(only on Diesel cars with automatic transmission)

Checking Adjustment of Control Rod (graduated disk)

Turn the control knob of the idle adjustment cable fully to the right. Adjust the idle by means of the idle stop screw on the venturi control unit.

The ball cup of the control rod (5) must fit the ball head (4) without forcing. If this is not the case the control rod length must be corrected before any further checks-are made (Fig. 27–4/8).

The pointer (10) attached to the operating lever of the modulating pressure transmitter is set to the zero mark of the graduated disk (11) Part No. 110 589 00 21 00 (Fig. 27–4/7). When this is being done the operating lever of the modulating pressure transmitter must rest against its zero stop (set screw) and the engine throttle valve must be closed.

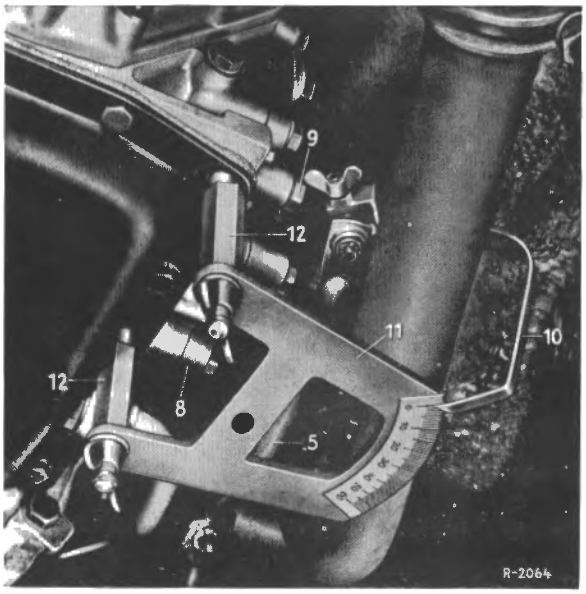


Fig. 27–4/7

5 Control rod
8 Modulating pressure control
9 Test connection for modulating pressure
10 Pointer
11 Graduated disk
12 Threaded bolt

Depress the accelerator pedal to full throttle (position B in Fig. 27–4/8). The pointer (10) on the graduated disk (11) should now point to the full-throttle value (see Job No. 27–0) and the spring-loaded valve should be fully open. For this type of test the kickdown value is of no importance. Release the accelerator pedal (7): The pointer should return to the zero mark on the graduated disk. If required free up the joints of the control rod. **The basic adjustment screw (10) has been set in our works; under no circumstances should its setting be altered (Fig. 27–4/8).**

Checking Adjustment of Control Rod (Modulating Pressure Gage)

Attach a modulating pressure gage to the test connection (9) (Figs. 27–4/7 and 8).

Turn the control knob of the idle adjustment cable fully to the right. Run the engine, move the selector lever to one of the driving positions and depress the accelerator to full throttle (position B in Fig. 27–4/8).

Caution: To prevent damage to the engine and overheating of the hydraulic clutch, the engine should be run at full throttle only for a very short time.

The pressure gage should now indicate the full throttle modulating pressure (see Job No. 27–0). The spring-loaded connecting rod should have been extended by approx. 2 to 5 mm. The throttle valve should be fully open. When the full throttle value has been readjusted, the modulating pressure will have to be checked again during a test run.

Check idle, full throttle and kickdown modulating pressure. If the idle modulating pressure is not reached, the operating lever of the modulating pressure transmitter will not return to its zero position. If required free up the joint of the control rod. **The basic adjustment screw (10) has been set in our works; under no circumstances should its setting be altered (Fig. 27–4/8).**

Adjustment of Control Rod

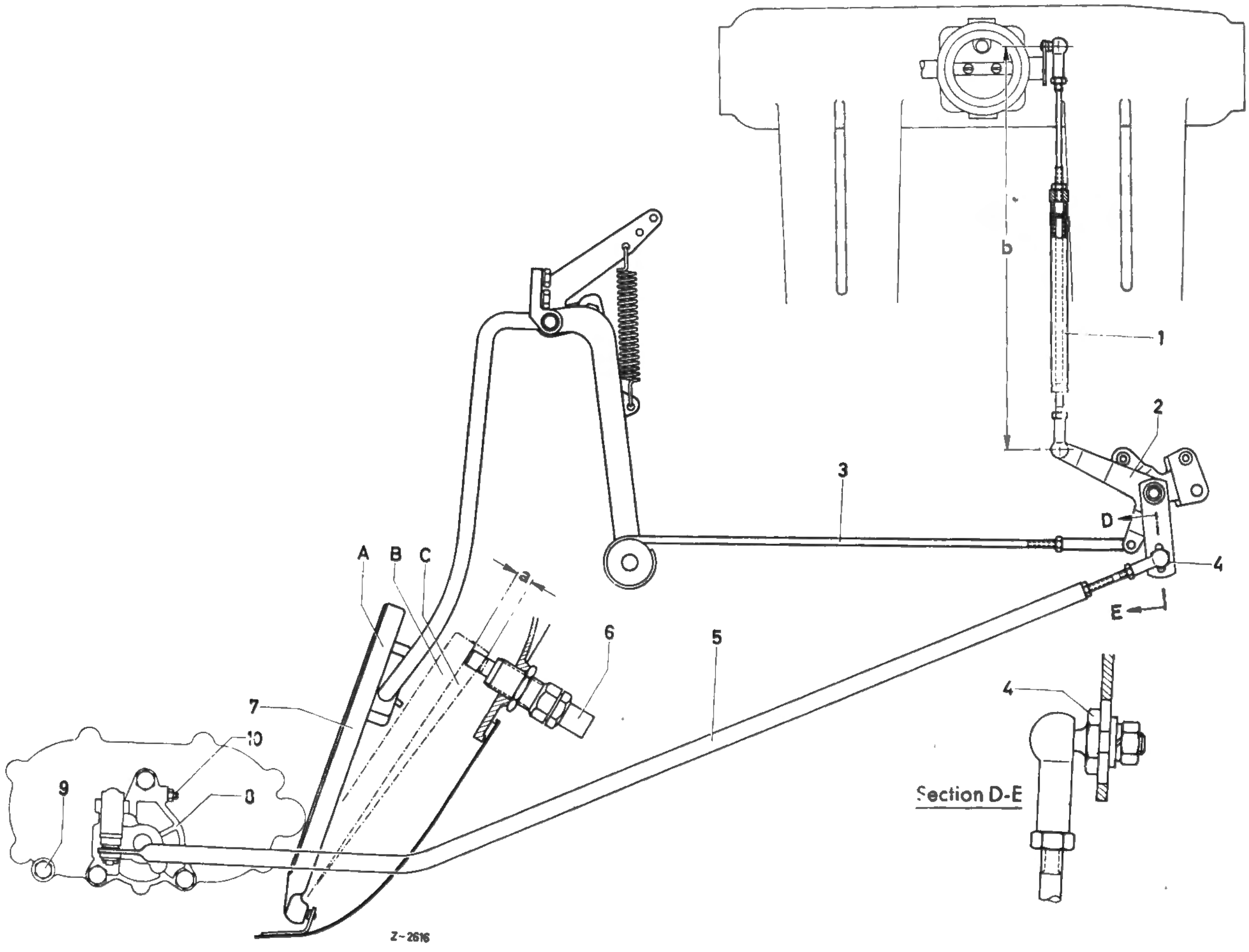


Fig. 27–4/8

1 Spring-loaded connecting rod
2 Angle lever
3 Push rod
4 Ball head
5 Control rod
6 Spring-loaded stop (kickdown change-down)
7 Accelerator pedal
8 Modulating pressure transmitter
9 Test connection for modulating pressure
10 Basic adjustment screw

Positions of accelerator pedal
A Idling B Full throttle C Kickdown
a Kickdown travel
b Non-extended length of connecting rod

If the ball cup of the control rod (5) cannot be pressed on the ball head (4) without forcing, the length of the control rod must be adjusted by means of the threaded member between ball cup and rod. If the throttle valve opens when the ball cup is being pressed on, the rod must be shortened. If the operating lever of the modulating pressure transmitter is lifted off its zero stop, the rod must be lengthened.

If the angular travel at the full throttle point or the full throttle modulating pressure is excessive, the ball head (4) must be shifted upward in its slot; if the angular travel or the full throttle modulating pressure is insufficient the ball head must be shifted downward (Fig. 27–4/8).

Basic Adjustment

A replacement modulating pressure transmitter needs adjustment.

The following tools are required:

Modulating pressure gage and graduated disk.

Turn the control knob of the idle adjustment cable fully to the left (increased idle speed).

Connect modulating pressure gage, attach graduated disk with pointer, detach spring-loaded connecting rod (1) at its lower ball head (Fig. 27–4/8) and run the engine. Detach the control rod (5), shorten it by approx. 5 mm, and reattach. Depress the accelerator pedal (7) to the point where it can be seen on the pressure gage of jumping up to the kickdown pressure. At exactly this moment set the pointer of the graduated disk to the basic adjustment value (see Job No. 27–0).

Shut off the engine, release the accelerator pedal (7), and detach the control rod (5). Let the operating lever of the modulating pressure transmitter rest against the basic adjustment screw (10) (Fig. 27–4/8). Turn the basic adjustment screw until the pointer points to the zero mark on the graduated disk (Fig. 27–4/7).

Attach the spring-loaded connecting rod (1) and adjust the control rod (see above).

Diagnosis Guide

Job No.
27–7

This list makes no claim for completeness and attention should also be paid to combinations of the individual conditions named here.

Prior to any corrections, be sure to complete the basic checkup (refer to gear test Job No. 27–8).

A. Troubles during Operation and when Shifting Manually

Cons. No.	Trouble	Cause
1	Starting Motor cannot be operated	1. Starting motor faulty 2. Selector lever indication is wrong 3. Starter locking switch makes no contact
2	Car begins to move when starter is operated	1. Faulty linkage adjustment 2. Short circuit in starter locking switch
3	Heavy starting jolt	Idling speed of engine too high
4	Engine stalls when driving range is selected	1. Idling speed of engine faulty 2. Engine speed fluctuates (only in vehicles with injection engines): a) Solenoid defective b) Oil pressure earthing switch defective c) Cables or their joints defective or loose d) Fuse blown
5	Excessive creeping of car	Idling speed of engine too high (in vehicles with injection engines: Constant speed solenoid set too high)
6	No power transmission in selector lever position "R", all forward ranges in order	1. Brake band B 3 wrongly adjusted 2. Brake band B 3 or lining mechanically destroyed 3. Clutch K 3 or disk linings mechanically destroyed or burned 4. Too low or no operating pressure a) Shift sleeve 30 stuck b) Round cord ring on plug pipe stuck or damaged c) Lip sealing ring on brake band piston B 3 or clutch piston K 3 damaged

Cons. No.	Trouble	Cause
7	No power transmission in selector lever position "R", in forward positions up to approx. 9 miles/h bad power transmission (slip), particularly when warm. Above 9 miles/h transmission behaves normal. Parking lock cannot be engaged with the engine running	Check valve of secondary pump (15) defective (pressure of primary pump escapes over secondary pump duct)
8	No power transmission in all driving positions (weak forward creeping in all selector lever positions except "P")	Too little or no operating pressure 1. Primary pump out of order
	or shift members engage only at higher engine speeds (approx. 3,000 r.p.m.)	2. Main pressure control sleeve (11) stuck (pressure buildup with increasing engine speed)
9	No return shifting from kickdown	Kickdown modulating pressure too low 1. Double-acting solenoid attains no kickdown position a) Kickdown switch badly adjusted or defective b) Cables or their joints defective or loose c) Fuse blown d) Double-acting solenoid defective 2. Kickdown linkage disconnected, worn or broken 3. Floor mat insufficiently cut out
10	Brake shifting impossible	One or more shift sleeves stuck (sleeves 1, 2, 10, 18, 19, 20, 25, 26)
11	No brake shifting 4,000 ft. above sea level	Double-acting solenoid will not attain lifting position
12	Parking lock is not locking	1. Gear shifting gate on shifting linkage is not accurately adjusted, loose or bent 2. Shifting linkage is not accurately adjusted 3. Secondary pump duct is under oil pressure 4. Interlocking sleeve for parking lock stuck 5. Resilient linkage of parking lock mechanism not accurately adjusted
13	Hydraulic interlock for "R" and "P" ineffective above 9 miles/h	1. Secondary pump supplies no or insufficient oil pressure 2. Sleeve 30 or interlocking sleeve for parking lock stuck
14	Engine will not start when the vehicle is towed	1. Engine defective 2. Sleeve 9 or 11 stuck 3. Insufficient oil pressure

B. Trouble during Automatic Shifting

Cons. No.	Trouble	Cause
1	General shifting trouble, such as: 1. Engine races with driving range selected 2. Irregular shifting 3. Heavily retarded brake shifting, particularly in cold transmission	Generally, the cause is contamination (check by removing oil pan) **Note:** If there are excessive chips or shavings, burned abrasive dust and other foreign bodies, completely disassemble and clean transmission and repair, if required. If the oil pan is clean (individual aluminium chips are unimportant), replacing or repairing the sleeve shift box is sufficient to repair the trouble
2	Engine races in 3rd **and** 4th gear	Clutch K 1 inoperative 1. Mechanical destruction 2. Insufficient or no operating pressure (sleeve 27 is open)
3	Engine races in 2nd **and** 4th gear	Clutch K 2 inoperative 1. Mechanical destruction 2. Insufficient or no operating pressure a) Round cord ring on plug pipe stuck or damaged b) Sleeve 28 is open
4	Engine races in 1st **and** 2nd gear	Brake band B 1 inoperative 1. Mechanical destruction of brake band or lining 2. Brake band does not grip because oil pressure remains at lift end a) Thrust bearing does not close b) Slot ring in sleeve shift box leaks c) Lifting sleeve 18/19 stuck **Note:** re 2 a and b Brake shiftings are possible and small torques are transmitted, but engine races at increased throttle because the brake band piston lift end receives pressure over lifting sleeve 18/19 3. Brake band shift end receives insufficient oil pressure a) Quick-action valve in brake band piston is open b) Piston ring heavily leaky
5	Engine races in 1st **and** 3rd gear	Brake band B 2 inoperative 1. Mechanical destruction of brake band or lining 2. Brake band does not grip because oil pressure remains at lift end a) Thrust bearing will not close b) Slot ring in sleeve shift box leaks c) Lifting sleeve 20 stuck (continued next page)

Cons. No.	Trouble	Cause
5	Engine races in 1st **and** 3rd gear. (continued)	**Note:** re 2a and b Brake shiftings are possible and small torques are transmitted, but engine races at increased throttle because the brake band piston lift end receives pressure over lifting sleeve 20 3. Brake band shift end receives insufficient oil pressure a) Quick-action valve in brake band piston is open b) Piston ring heavily leaky
6	Engine races when throttle is increasingly opened (all driving ranges)	Modulating pressure too low 1. Double-acting solenoid remains in lifting position (lifting switch makes erroneously contact or has a short circuit) 2. Modulating pressure control sleeve 25 3. Diaphragm portion of modulating pressure transmitter stuck
7	Transmission does not shift beyond 2nd gear	1. Sleeve 7 stuck 2. Control sleeve Ü 1 is open (no stepped pressure)
8	Transmission does not engage beyond 2nd gear and tachometer does not indicate	1. Regulating pump is not driven 2. Worm gear drive of regulator defective
9	Transmission will not change to 4th gear in selector lever position 4	1. Stepped pressure too low 2. Sleeve 16 stuck 3. Ball valve between regulating pump and secondary pump leaks
10	Upshifts occur independent of gas pedal position (except kickdown) always at full throttle shift points	1. Underpressure line loose or clogged 2. Modulating pressure control sleeve 25 stuck
11	Upshifts occur independent of gas pedal position always at kickdown shift points. Starting always in 1st gear	Constant kickdown modulating pressure 1. Double-acting solenoid remains in kickdown position, electric connections may be interchanged: Cable from constant speed solenoid connected to kickdown 2. Modulating pressure control sleeve 25 stuck 3. Sleeve in modulating pressure transmitter stuck

C. Noises

Cons No.	Trouble	Cause
1	Chattering, rattling noise with running engine while driving and standing still	1. Primary pump sucks air (oil level too low) 2. Oil strainer soiled
2	Whining noise rising with increasing engine speed	Primary pump loud
3	Whining noise in 4th gear at 48 to 67 miles/h	Angle drive (regulator drive) loud
4	Grunting noise at idling speed	Sleeve vibrations (unimportant flaw, will cause no trouble). Replace shift sleeve housing bottom portion
5	2nd gear loud	Front planet gear set loud
6	Transmission in 3rd gear loud	Rear planet gear set loud

D. Miscellaneous

Cons. No.	Trouble	Cause
1	Badly colored and badly smelling gear oil during oil level checkup	Shift members (mainly disk clutches) burned and destroyed. Generally a secondary damage; the primary damage is often excessively low modulating pressure in full throttle and kickdown ranges, stuck shift sleeves, and the like
2	Heavy exhaust fumes	Diaphragm in modulating pressure transmitter is leaky or destroyed, gear oil reaches intake tube (close underpressure line immediately!)
3	"Creeping" oil losses	1. Diaphragm in modulating pressure transmitter leaks, gear oil reaches intake tube 2. Other leaks

# Pedals 	Group 29

# Control System 	Group 30

Job No.
29-0

Pedals

General Data, Dimensions, and Tolerances

Modification: Two-Circuit Brake, Models 230 SL and 300 SE with Mechanical Transmission added

Supply Cylinder and Extraction Cylinder

Model	Version	Supply Cylinder		
		Stroke mm	Nominal diameter in inches	in mm
190 c, 190 Dc	1st and 2nd	34		
220 b, 220 Sb, 220 SEb	1st	30	3/4"	19.05
220 b, 220 Sb, 220 SEb	2nd	34		
220 b, 220 Sb, 220 SEb	3rd			
230 SL	—	34	15/16"	23.81
300 SE[1])	—			
Model		Extraction Cylinder		
190 c, 190 Dc, 220 b, 220 Sb, 220 SEb	1st	minimum 21[2])	13/16"	20.64
190 c, 190 Dc	2nd	minimum 23[2])		
230 SL (1st vers.), 220 b, 220 Sb, 220 SEb	2nd		1"	25.4
300 SE[1])	—	minimum 18[2])	1 1/8"	28.57

[1]) With mechanical transmission
[2]) If the clearance between piston rod and piston of the supply cylinder and the specified clutch pedal travel is adjusted correctly, this minimum stroke on the extraction cylinder must be obtained when the clutch pedal is pressed down.

Adjusting Dimension (continued on next page)

Model	190 c, 190 Dc, 220 b 220 Sb, 220 SEb, 300 SE	190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL, 300 SE
Brake system	Single-circuit brake	Two-circuit brake
Free play of the push rod of the extraction cylinder up to the contact of the throw-out bearing with the throw-out forks of the clutch pressure plate	4[1])	
Clearance "a" between piston and piston rod of the supply cylinder (see Fig. 29-6/1)	0.1—0.2[1])	
Clearance "a" between piston and piston rod of the master cylinder (see Fig. 42-3/1)	0.5—0.7	—
Free play of brake pedal	approx. 4—5	no play[2])

[1]) On Model 300 SE with mechanical transmission.
[2]) On models with power-brakes T 51/100 and T 51/200 there is no play.

Adjusting Dimensions (continued)

<table>
<tr><th rowspan="2">Model</th><th rowspan="2">Brake system</th><th colspan="2">Control dimension "b" (see Fig. 29-2/1)</th><th colspan="2">Pedal travel "d" to the cowl (see Fig. 29-2/1)</th><th rowspan="2">Adjusting dimension "c" (see Fig. 29-2/1)</th></tr>
<tr><th>Brake pedal</th><th>Clutch pedal</th><th>Brake pedal</th><th>Clutch pedal</th></tr>
<tr><td>190 c, 190 Dc</td><td>Single-circuit brake</td><td>48,5</td><td>44.5</td><td>approx. 168</td><td>approx. 163</td><td>67 + 1</td></tr>
<tr><td>190 c, 190 Dc</td><td>Two-circuit brake</td><td>63.5</td><td>—</td><td>approx. 152</td><td>approx. 163</td><td>67 + 1</td></tr>
<tr><td>220 b, 220 Sb, 220 SEb
1st version</td><td>Single-circuit brake</td><td>45.5</td><td>41.5</td><td>approx. 152</td><td>approx. 147</td><td rowspan="2">61 + 1</td></tr>
<tr><td>220 b, 220 Sb, 220 SEb
2nd version</td><td>Single-circuit brake</td><td>45.5</td><td>44.5</td><td>approx. 152</td><td>approx. 163</td></tr>
<tr><td>220 b, 220 Sb, 220 SEb,
230 SL, 300 SE</td><td>Two-circuit brake</td><td>63.5</td><td>—</td><td>approx. 152</td><td>approx. 163[1])</td><td>67 + 1[1])</td></tr>
<tr><td>300 SE</td><td>Single-circuit brake</td><td>45.5</td><td>44.5[1])</td><td>approx. 152</td><td>approx. 163[1])</td><td>61 + 1[1])</td></tr>
</table>

[1]) Model 300 SE with mechanical transmission

Piston Rod, Push Rod, and Pressure Pin

<table>
<tr><th rowspan="2" colspan="2">Model</th><th colspan="2">220 b, 220 Sb, 220 SEb</th><th rowspan="2">190 c, 190 Dc, 300 SE[1]) 1st version and 220 b, 220 Sb, 220 SEb, 3rd version</th><th rowspan="2">230 SL and 190 c, 190 Dc, 300 SE[1]) 2nd version 220 b, 220 Sb, 220 SEb, 4th version</th></tr>
<tr><th>1st version</th><th>2nd version</th></tr>
<tr><td rowspan="2">Piston rod</td><td>Part No.</td><td colspan="2">111 290 09 39</td><td>111 290 16 39</td><td>110 290 18 39</td></tr>
<tr><td>Length "L" (Fig. 29-3/4)</td><td colspan="2">46</td><td>56</td><td>100</td></tr>
<tr><td rowspan="2">Push rod</td><td>Part No.</td><td>111 295 05 33</td><td colspan="3">111 295 07 33</td></tr>
<tr><td>Length</td><td>49</td><td colspan="3">43</td></tr>
<tr><td rowspan="2">Pressure pin</td><td>Part No.</td><td>000 295 00 74</td><td>000 295 01 74</td><td colspan="2">000 295 03 74</td></tr>
<tr><td>Length</td><td>38</td><td>45</td><td colspan="2">53</td></tr>
</table>

[1]) Model 300 SE with mechanical transmission.

Removal and Installation of Support together with the Pedals

Job No.
29-1

Modification: Pedal system with Inside Supply Cylinder added

A. Pedal System with Outside Supply Cylinder

Removal:

1. Take off the cover below the instrument panel.
2. Unscrew the bearing bracket (21) for the ratchet from the support (Fig. 29-1/1).

Note: In the case of models that are equipped with a hand-brake warning light take the plug out of the switch.

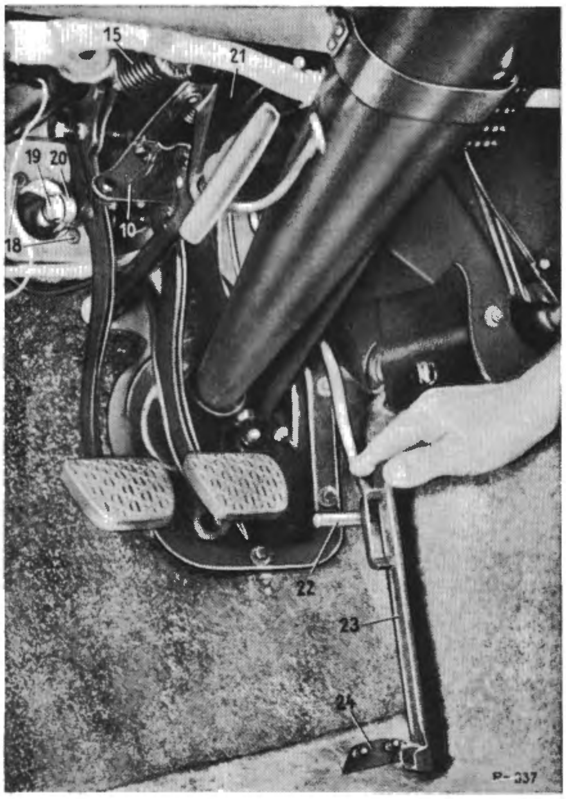


Fig. 29-1/1

10 Stop
15 Pressure spring (dead center spring)
18 Hexagon screw
19 Adjusting screw
20 Piston rod
21 Bearing bracket for ratchet
22 Adjustment lever
23 Foot plate
24 Bracket with ball heads

3. Unscrew the wing nut fastening the instrument cluster, and pull out the instrument cluster a little way. It is not necessary to disconnect the cables at the instrument cluster.
4. Unscrew the two hexagon nuts (1) and remove together with washer (2) (Fig. 29-1/2).

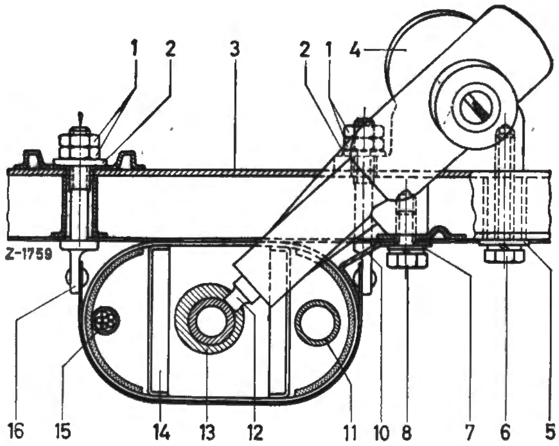


Fig. 29-1/2

1 Hexagon nuts for tightening strap
2 Washer
3 Cross member
4 Steering lock
5 Washer
6 Hexagon screw with lock washer
7 Washer
8 Hexagon screw with lock washer
10 Bracket on steering column jacket for attachment of steering lock
11 Shift tube
12 Lock bolt of the steering lock
13 Lock ring on steering tube
14 Steering column jacket
15 Wiring harness for flash signal switch and signal horns
16 Tightening strap

5. Unscrew the hexagon nuts of the two hexagon screws with which the support and the brake master cylinder are fastened to the intermediate flange and the cowl.
6. Remove the support together with the pedals paying attention to the shims (20) which are installed between the cross member (18) and the support (7) (Fig. 29-1/3).

Installation:

7. Fasten the support together with the pedals to the cowl and the cross member. Make sure that the piston rods for the supply cylinder and the brake master cylinder properly engage the pistons of the cylinders.
8. Measure the travel "d" of the brake pedal from the released position to the contact of the pedal with the cowl. The travel specified in Job No. 29-0 must be obtained.

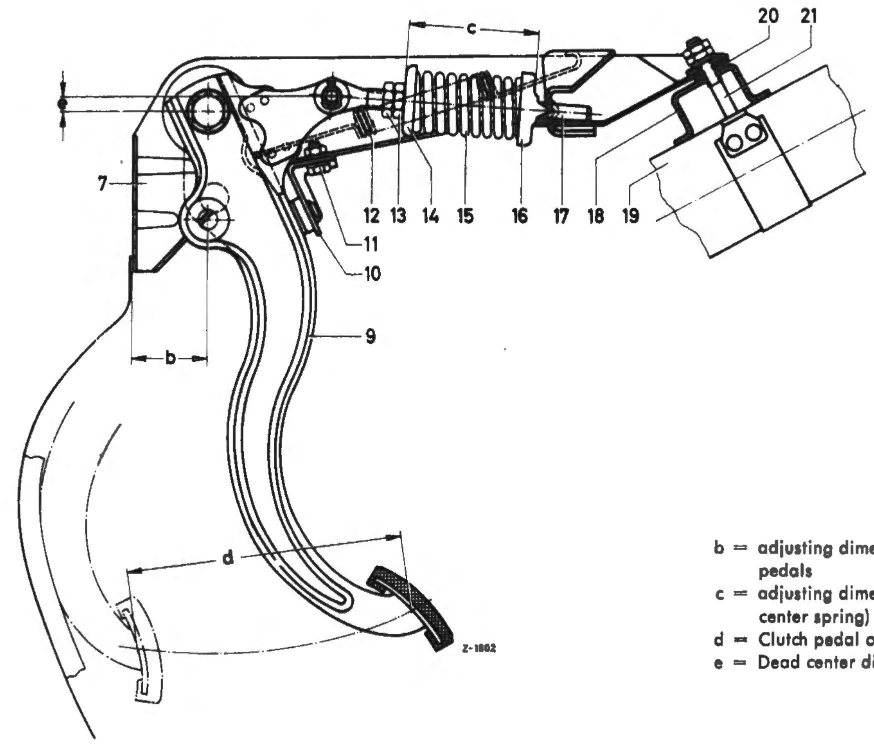


Fig. 29-1/3

7 Support for pedals
9 Clutch pedal
10 Bracket and stop
11 Hexagon screw
12 Return spring for brake pedal
13 Hexagon nut
14 Spring retainer
15 Pressure spring (dead center spring)
16 Spring retainer
17 Push rod
18 Cross member
19 Steering column jacket
20 Shim
21 Tightening strap

b = adjusting dimension of clutch and brake pedals
c = adjusting dimension of pressure spring (dead center spring)
d = Clutch pedal or brake pedal travel
e = Dead center dimension

If this is not the case disconnect the support again and put a shim 111 589 00 75 (20) between cross member (18) and support (7).

Note: The brake pedal travel from release position to contact with the cowl has been carefully fitted into the overall design and must be adjusted with the utmost care. The dimensions given in Job No. 29-0 must be considered an absolute minimum.

The best method of measuring the brake pedal travel is to use a tape to determine the distance between brake pedal plate center and lower edge of signal horn ring. Then back out a bleed screw and depress the brake pedal until it rests against the cowl. Brake travel is the difference between these two measurements. Close the bleed screw before releasing the brake pedal.

9. Check and adjust the clearance "a" between the piston rod on the clutch pedal and the piston of the supply cylinder (see Job No. 29-6, Section A).

10. Check and adjust the clearance "a" between the piston rod at the brake pedal and the piston of the brake master cylinder (see Job No. 42-20, Section B).

B. Pedal System with Inside Supply Cylinder

Removal:

1. Remove the cover below the instrument panel.

2. On Model 230 SL remove the revolution counter (see Job No. 54-11, Section B).

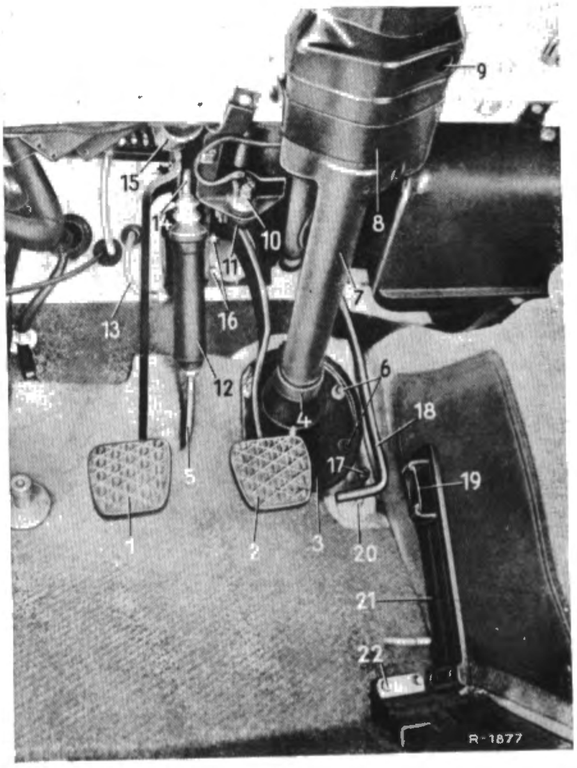


Fig. 29-1/4

Arrangement on Model 230 SL

1 Clutch pedal
2 Brake pedal
3 Cover plate
4 Pipe clip
5 Line to extraction cylinder
6 Hexagon screw with washer
7 Steering column jacket
8 Tightening strap
9 Opening for slotted screw
10 Mechanical stop light switch
11 Stop ring for brake pedal
12 Supply cylinder
13 Line from reservoir to supply cylinder
14 Piston rod
15 Pressure spring (dead center spring)
16 Hexagon screw with lock washer and hexagon nut
17 Stop screw
18 Pedal lever
19 Plastic plate
20 Hexagon nut
21 Foot plate
22 Bracket with ball heads

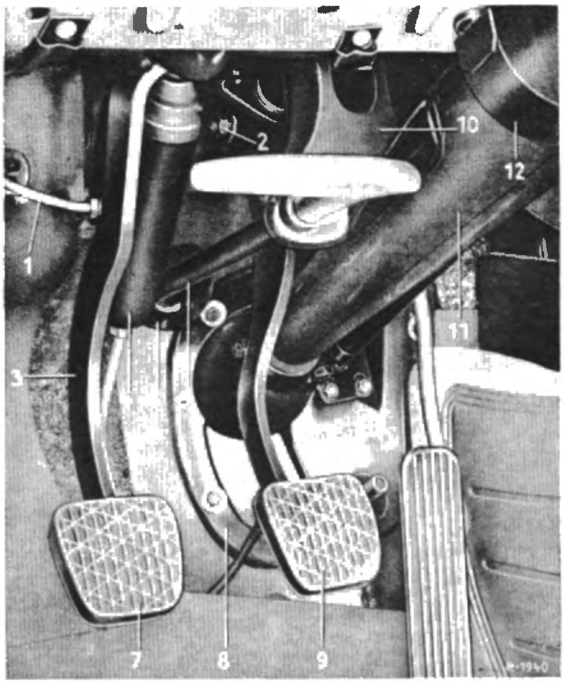


Fig. 29-1/5

Arrangement on Models
190 c, 190 Dc, 220 b, 220 Sb, 220 SEb

1 Line from reservoir to supply cylinder
2 Adjusting screw with hexagon nut and lock washer
3 Clutch pedal
4 Supply cylinder
5 Rubber sleeve
6 Guide tube for ratchet
7 Pedal plate on clutch pedal
8 Cover plate
9 Brake pedal
10 Bearing bracket for guide tube
11 Steering column jacket
12 Tightening strap

3. Pump the brake fluid from the reservoir of the supply cylinder via the opened bleed screw of the extraction cylinder.

4. Detach from the supply cylinder (12) both the line (13) from the reservoir and the line (5) to the extraction cylinder (Fig. 29-1/4).

5. On models with pistol-grip hand brakes unscrew the bearing bracket (10) for the ratchet from the pedal support (Fig. 29-1/5).

6. Unscrew the two hexagon nuts (1) which fasten the pedal support to the cross member (3) and remove together with the washer (2) (Figs. 29-1/2 and 6).

Note: On Model 230 SL the hexagon nuts are accessible through the opening for the revolution counter in the instrument panel.

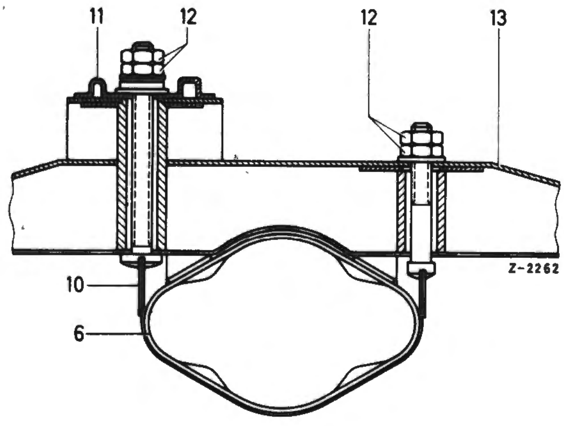


Fig. 29-1/6

Arrangement on Model 230 SL

6 Steering column jacket
10 Tightening strap
11 Pedal support
12 Hexagon nut
13 Cross member

7. Unscrew the hexagon nut from the adjusting screw (3a) and remove the adjusting screw from the brake pedal (13) in order to detach the piston rod (2) of the power brake from the brake pedal (Fig. 29-1/7).

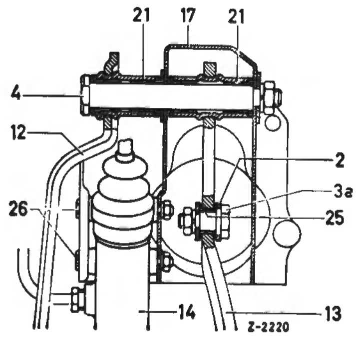


Fig. 29-1/7

Arrangement on Models
190 c, 190 Dc, 220 b, 220 Sb, 220 SEb

2 Piston rod of power brake
3a Adjusting screw with hexagon nut and lock washer
4 Pivot pin with hexagon nut and lock washer
12 Clutch pedal
13 Brake pedal
14 Supply cylinder
17 Pedal support
21 Bushings in the pedals
25 Bushings in the brakes
26 Hexagon screw with hexagon nut and lock washer

Note: On Model 230 SL this operation is not required, since the force exerted on the brake pedal is transferred to the power brake via the push rod and the relay lever in the bearing bracket.

8. Unscrew the hexagon nuts with which the power brake with the tandem master cylinder and the pedals are attached to the cowl.

9. Remove the support together with the pedals, paying attention to the shims installed between the support (7) and the cross member (8) (Fig. 29-1/3).

Installation:

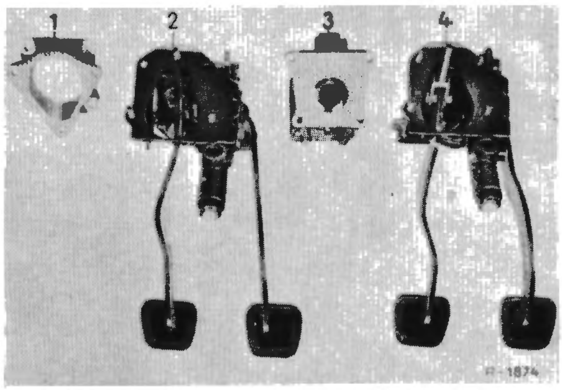


Fig. 29-1/8

1 Intermediate flange
2 Pedals for Models
190 c, 190 Dc, 220 b, 220 Sb, 220 SEb
3 Bearing bracket with relay lever
4 Pedals for Model 230 SL

10. Attach the support together with the pedals and the intermediate flange to the cowl, and attach the power brake together with the tandem master cylinder to the cowl.

Note: Before installing the pedals on Model 230 SL make sure that the rubber sleeve (17) is seated properly. The rubber sleeve partly covers the push rod (16) and seals the passenger compartment off from the engine compartment (Fig. 29-1/9).

11. On all cars on which the piston rod of the power brake is attached directly to the brake pedal, use the adjusting screw to attach the piston rod to the brake pedal, but do not yet tighten the hexagon nut.

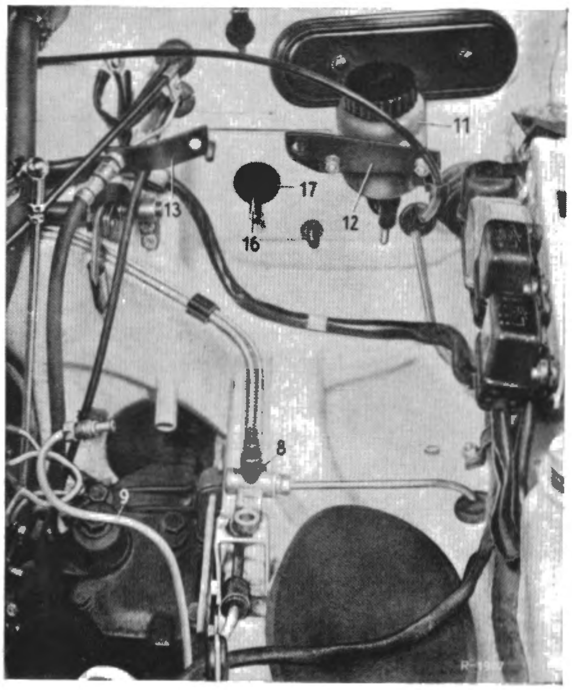


Fig. 29-1/9

8 Distributor fitting
9 Brake line
11 Reservoir for supply cylinder
12 Reservoir bracket
13 Bracket for oil pressure gage line
16 Push rod on brake pedal
17 Rubber sleeve

12. Fasten the pedal support to the cross member and measure the travel "d" of the brake pedal between the off-position and the point where it rests against the cowl. The prescribed travel given in Job No. 29-0 must be obtained. If this is not the case, detach the pedal support again and install a Shim 111 589 00 75 (20) between the cross member (18) and the pedal support (7) (Fig. 29-1/3).

Note: It is imperative that the prescribed brake pedal travel from off-position to cowl contact should be obtained. Measurements should never be below those given in Job No. 29-0.

The most convenient way of measuring the brake pedal travel is to use a tape measure to measure the distance from center brake pedal plate to lower edge of signal horn ring. Then open a bleed screw and depress the brake pedal until it rests against the cowl. The difference between these two dimensions is the brake pedal travel. Before releasing the brake pedal, screw down the bleed screw.

13. Check and adjust the clearance "a" between the piston rod on the clutch pedal and the piston of the supply cylinder (see Job No. 29-6, Section A).

14. Use the adjusting screw (2), or on Model 230 SL adjusting screw (3a) in order to set the maximum brake pedal travel (see Job No. 42-20 and Figs. 29-1/5 and 42-20/3).

15. On all models with pistol-type hand brake attach the bearing bracket for the ratchet to the support and check the adjustment of the hand brake (see Job No. 42-20).

16. Attach the feed line from the reservoir, and the pressure line to the extraction cylinder, to the supply cylinder and bleed the hydraulic system (see Job No. 29-5).

17. On Model 230 SL install the revolution counter (see Job No. 54-11).

18. Install the cover under the instrument panel.

Job No.
29-2

Removal and Installation of Pedals from the Support

Modification: Para 9 modified, Sections B and C added

A. Pedal System with Outside Supply Cylinder

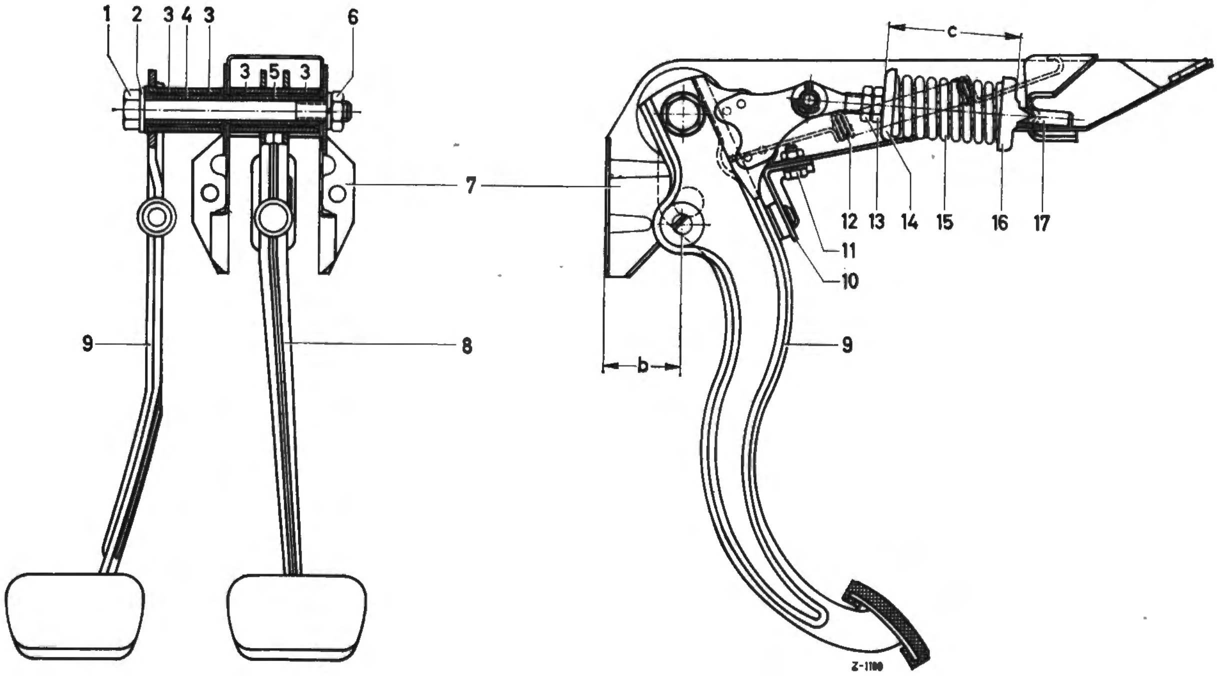


Fig. 29-2/1

1 Hexagon screw
2 Washer
3 Bushing
4 Bearing sleeve
5 Bearing sleeve
6 Hexagon nut
7 Support
8 Brake pedal
9 Clutch pedal
10 Bracket and stop
11 Hexagon screw
12 Return spring for brake pedal
13 Hexagon nut
14 Spring retainer
15 Pressure spring (dead center spring)
16 Spring retainer
17 Push rod

Removal:

1. Back out the hexagon nuts (13) in order to release the pressure spring (15) (dead center spring) (Fig. 29-2/1).

2. Pull the cotter pin out of the collar bolt (24) and remove the collar bolt from the clutch pedal (9). Then remove the push rod (17) together with the spring retainers (14) and (16) and the pressure spring (15) (Fig. 29-2/2).

3. Detach the return spring (12) at the brake pedal (Figs. 29-2/1 and 29-2/2).

4. Unscrew the hexagon nut of the adjusting screws (19) and (25) at the brake and the clutch pedal and remove the two adjusting screws together with the piston rods (Fig. 29-2/2).

5. Unscrew the hexagon nut (6), remove the lock washer and tap out the hexagon screw (1) (Fig. 29-2/1).

Checking:

6. Check the sleeves (4) and (5) and the bushings (3) in the pedals for wear. If necessary, press the bushings out of the pedals. Press in new bushings and ream them up to the prescribed diameter.

7. Check the polyamide bushings in the piston rods for wear and if necessary replace them.

Installation:

8. When reinstalling the sleeves and bushings, lightly coat them with Molykote paste.

9. Check the position of the pedals in the support (7). To do this, put a ruler against the face of the support and measure the distance 'b' from the face of the support to the center of the fulcrum and to the center of the adjusting screw bore. The prescribed distance is adjusted by moving the stop (10) (Fig. 29-2/1).

Note: The dimension "b" for the brake and clutch pedals differs on the 1st and 2nd versions of the pedal system. The travel of the pedals (d) after installation depends on the proper adjustment of this dimension. In addition, dimension "b" also determines the dead center dimension "e" of the clutch pedal (Fig. 29-1/3).

10. Adjust the pressure spring (15) (dead center spring) to the dimension 'c'. Lock the adjusting nut (13) by means of the lock nut (Fig. 29-2/1).

11. Screw the piston rod (23) actuating the brake master cylinder to the brake pedal (8) by means of the adjusting screw (25), but do not yet tighten the hexagon nut (Fig. 29-2/2).

12. Screw the piston rod actuating the supply cylinder to the clutch pedal (9) by means of the adjusting screw (20), but do not tighten the hexagon nut.

Note: Before installation, the collar of the adjusting screws should be lightly coated with Molykote paste.

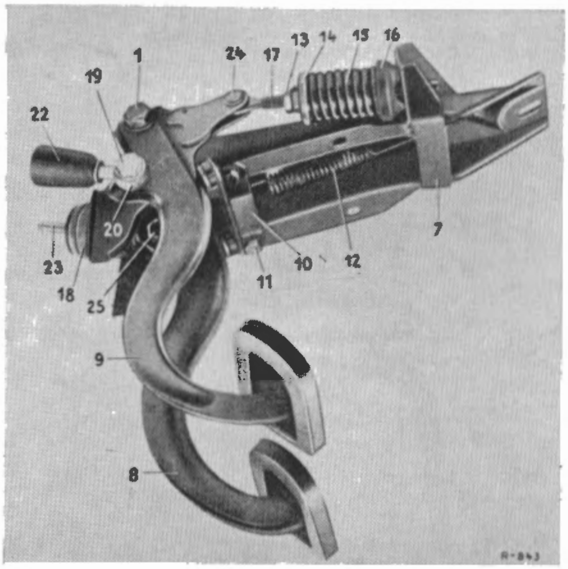


Fig. 29-2/2

1 Hexagon screw
7 Support
8 Brake pedal
9 Clutch pedal
10 Bracket and stop
11 Hexagon screw
12 Return spring for brake pedal
13 Hexagon nut
14 Spring retainer
15 Pressure spring (dead center spring)
16 Spring retainer
17 Push rod
18 Protective cap
19 Adjusting screw
20 Piston rod for supply cylinder
22 Protective cap
23 Piston rod for brake master cylinder
24 Collar bolt
25 Adjusting screw

B. Pedal System with Inside Supply Cylinder

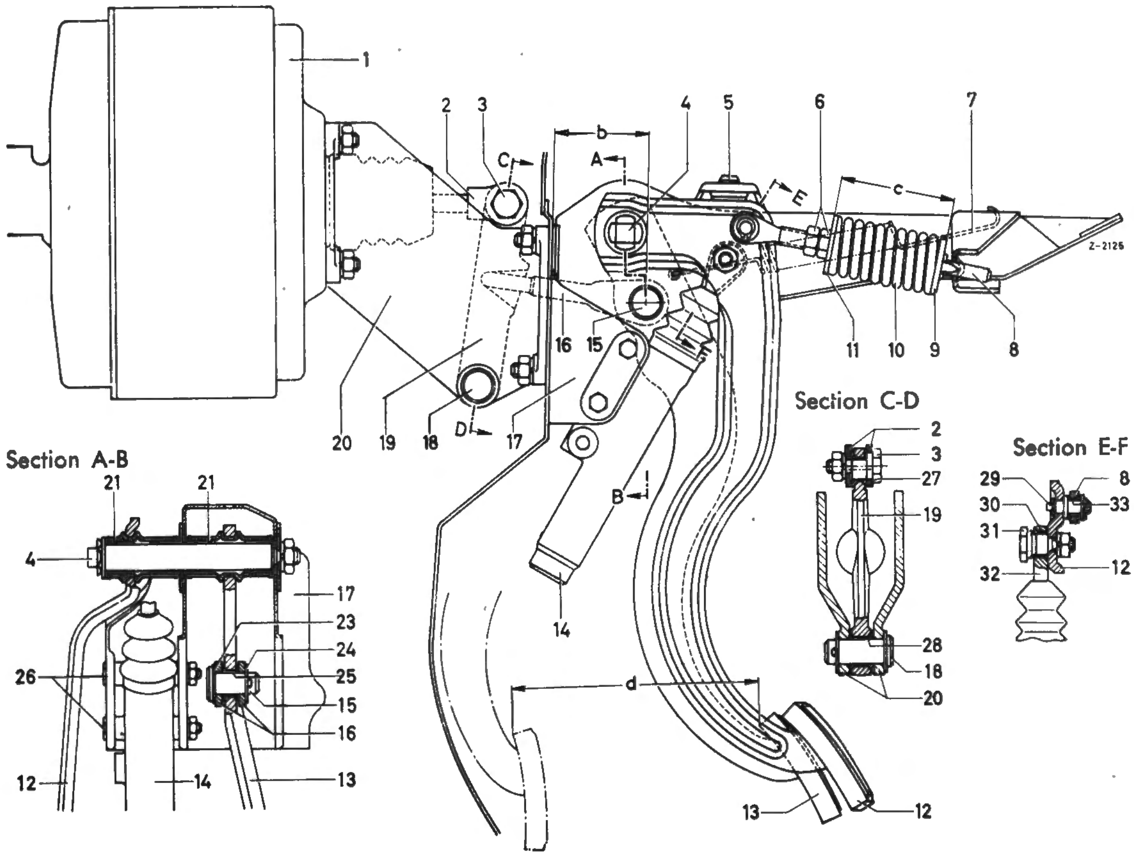


Fig. 29-2/3

Arrangement on Model 230 SL

b = Control dimension for brake pedal
c = Adjusting dimension for pressure spring (dead center spring)
d = Travel of the brake pedal until it rests on the cowl

1 Power brake T 51/200
2 Piston rod of power brake
3 Adjusting screw with lock washer and hexagon nut on the relay lever
4 Pivot pin
5 Rubber stop for clutch pedal
6 Hexagon nut
7 Return spring for brake pedal
8 Push rod for pressure spring
9 Spring retainer
10 Pressure spring (dead center spring)
11 Spring retainer
12 Clutch pedal
13 Brake pedal
14 Supply cylinder
15 Collar bolt
16 Push rod for intermediate lever
17 Support for pedals
18 Collar bolt with washer and cotter pin
19 Intermediate lever
20 Bearing bracket
21 Bushing for brake and clutch pedal
23 Spring washer
24 Washer
25 Bushing in the brake pedal for collar bolt
26 Hexagon screw with lock washer and hexagon nut
27 Bushing in the intermediate lever for adjusting screw
28 Bushing in the intermediate lever for collar bolt
29 Pivot pin for push rod
30 Bushing in the piston rod
31 Adjusting screw with lock washer and hexagon nut on the clutch pedal
32 Piston rod
33 Bushing in the push rod

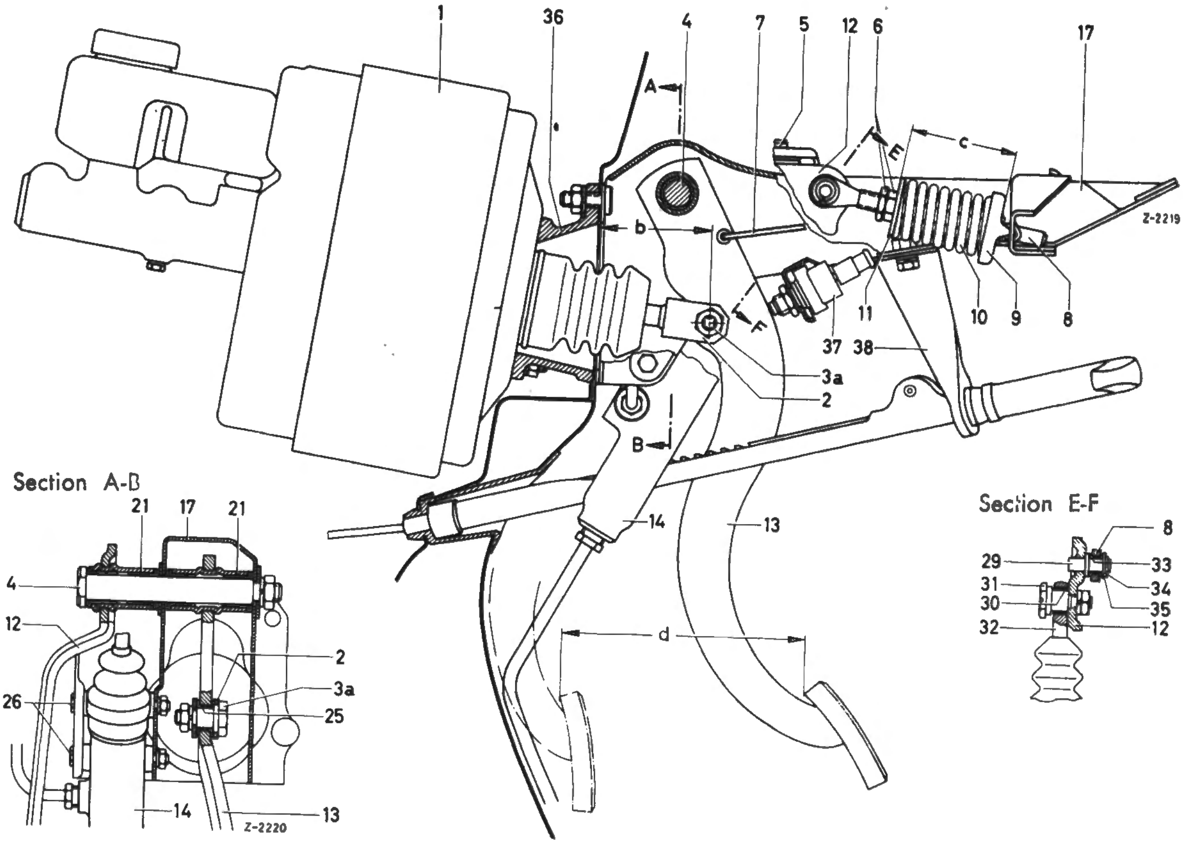


Fig. 29-2/4

Arrangement on Models 190 c, 190 Dc, 220 b, 220 Sb, 220SEb

b = Control dimension for brake pedal
c = Adjusting dimension for pressure spring (dead center spring)
d = Travel of the brake pedal until it rests on the cowl

1 Power brake T 51
2 Piston rod of power brake
3a Adjusting screw with lock washer and hexagon nut on brake pedal
4 Pivot pin
5 Rubber stop for clutch pedal
6 Hexagon nut
7 Return spring for brake pedal
8 Push rod for pressure spring
9 Spring retainer
10 Pressure spring
11 Spring retainer
12 Clutch pedal
13 Brake pedal
14 Supply cylinder
17 Pedal support
21 Bushings for brake and clutch pedal
25 Bushings in the brake pedal
26 Hexagon screw with lock washer and hexagon nut
29 Pivot pin for push rod
30 Bushing in the piston rod
31 Adjusting screw with lock washer and hexagon nut on clutch pedal
32 Piston rod
33 Bushing in the push rod
34 Snap ring
35 Washer
36 Intermediate flange
37 Mechanical stop light switch
38 Bracket for ratchet

Removal:

1. Unscrew the supply cylinder (14) from the pedal support (17) (Figs. 29-2/3 and 2/4 and Job No. 29-3).

2. Unscrew the hexagon nut from the adjusting screw (31) and remove the adjusting screw together with the piston rod (32) from the clutch pedal (12) (Figs. 29-2/3 and 2/4).

3. Completely back out the hexagon nuts (6) and depress the clutch pedal to release the pressure spring (10) (dead center spring) (Fig. 29-2/3).

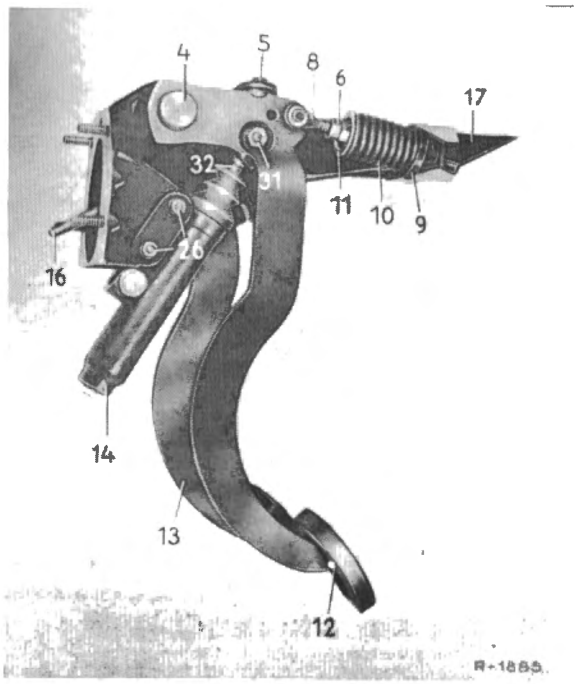


Fig. 29-2/5

4 Pivot pin
5 Rubber stop for clutch pedal
6 Hexagon nut
8 Push rod for pressure spring
9 Spring retainer
10 Pressure spring (dead center spring)
11 Spring retainer
12 Clutch pedal
13 Brake pedal
14 Supply cylinder
16 Push rod for relay lever
17 Pedal support
26 Hexagon screw with lock washer and hexagon nut
31 Adjusting screw with lock washer and hexagon nut
32 Piston rod

4. Remove the snap ring (34) from the pivot pin (29) together with the washer (35). Then take off the push rod (8) together with the spring retainers (9) and (11) and the pressure spring (10) (Fig. 29-2/4).

5. Detach the return spring (7) from the brake pedal (13) (Fig. 29-2/3).

6. Unscrew the hexagon nut from the pivot pin (4), press the pivot pin out of the pedal support (17) and remove both pedals from the support (Fig. 29-2/3).

7. Unscrew the stop light switch (3) from the bracket (2) (Fig. 29-2/7).

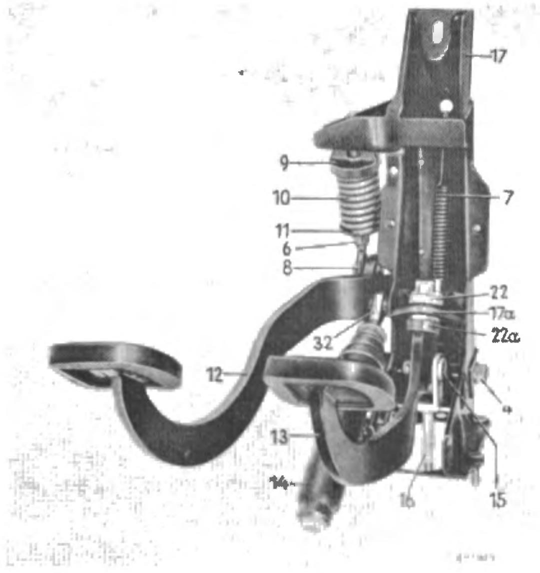


Fig. 29-2/6

6 Hexagon nut
7 Return spring for brake pedal
8 Push rod for pressure spring
9 Spring retainer
10 Pressure spring (dead center spring)
11 Spring retainer
12 Clutch pedal
13 Brake pedal
14 Supply cylinder
15 Collar bolt
16 Push rod for relay lever (only on Model 230 SL)
17 Pedal support
17a Bracket for stop light switch
22 Mechanical stop light switch
22a Stop ring (only on Model 230 SL)
32 Piston rod

8. On Model 230 SL pull the cotter pin out of the collar bolt (15) and remove the collar bolt together with push rod (16) and washers from the brake pedal (Fig. 29-2/4).

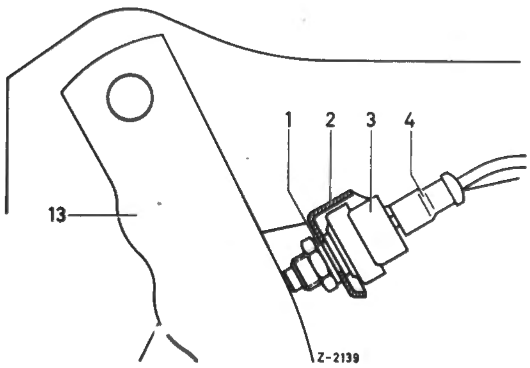


Fig. 29-2/7

1 Compensating washer
2 Bracket on the pedal support
3 Mechanical stop light switch
4 Plug connection
13 Brake pedal

Checking:

9. Check the bushings in the pedals for wear. If necessary, press the bushings out of the pedals, press in new bushings, and ream them to the prescribed dimension (see Job No. 29-0).

10. Check the bushings (25) in the brake pedal (13), the bushing (30) in the piston rod (32), the bushing (33) of the push rod (8), and the bushing in the spring retainer (9) for signs of wear and, if necessary, replace. After pressing in the bushings, ream them to the prescribed dimension (see Job No. 29-0 and Figs. 29-2/3 and 4).

Installation:

13. Before installation lightly rub all contact surfaces with Molycote paste and install the pedals in the support. Attach the return spring to the brake pedal and the support.

14. Install the pressure spring (10) (dead center spring) and adjust to the dimension "c" (see Job No. 29-0 and Fig. 29-2/3).

15. Attach the piston rod (32) for actuating the supply cylinder to the clutch pedal (12) (Figs. 29-2/3 and 4).

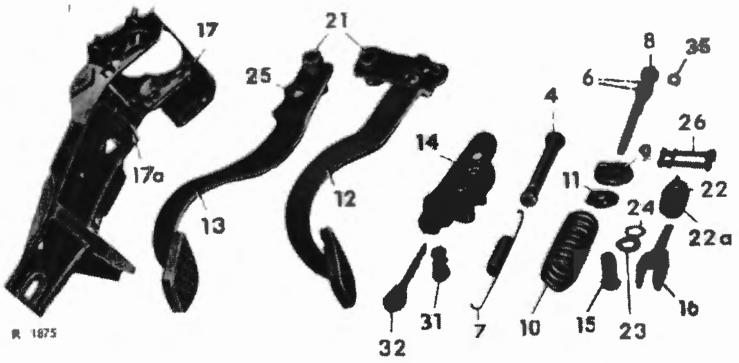


Fig. 29-2/8

4 Pivot pin with lock washer and hexagon nut
6 Hexagon nut
7 Return spring for brake pedal
8 Push rod for pressure spring
9 Spring retainer
10 Pressure spring (dead center spring)
11 Spring retainer
12 Clutch pedal
13 Brake pedal
14 Supply cylinder
15 Collar Bolt (only on Model 230 SL)
16 Push rod for relay lever (only on Model 230 SL)
17 Pedal support
17a Bracket for mechanical stop light switch
21 Bushing
22 Mechanical stop light switch
22a Stop ring (only on Model 230 SL)
23 Spring washer
24 Washer
25 Bushing
26 Hexagon screw with lock washer and hexagon nut
31 Adjusting screw with lock washer and hexagon nut
32 Piston rod
35 Washer

11. Check the rubber stop (5) for the clutch pedal (12) on the support (17) (Figs. 29-2/3 and 2/4).

12. Check whether the stop light switch functions properly.

Note: The mechanical stop light switch (3) is the stop for the brake pedal (Fig. 29-2/7).

16. On Model 230 SL attach the push rod (16) to the brake pedal (13) (Fig. 29-2/3).

Note: The spring washer (23) must be placed on the collar bolt before the bolt is being installed. The washer (24) should be on the cotter pin hole side (Fig. 29-2/3).

17. Attach the supply cylinder (4) to the support (17) and adjust the clearance between the piston and the piston rod (see Job No. 29-6 and Fig. 29-2/3).

18. Attach the stop light switch to the support.

Note: The stop light switch for Model 230 SL has a stop ring above the threaded part and this stop ring serves as a stop for the brake pedal. The stop is necessary, since on this model the push rod attached to the brake pedal is not fastened to the relay lever. Furthermore the stop light switch on Model 230 SL is held in position by a lock plate.

C. Removal and Installation of Relay Lever from the Bearing Bracket on Model 230 SL

Removal:

1. Remove the power brake with the tandem master cylinder (see Job No. 42-16).

2. Unscrew the hexagon nuts which fasten the bearing bracket together with the pedals to the cowl and remove the bearing bracket.

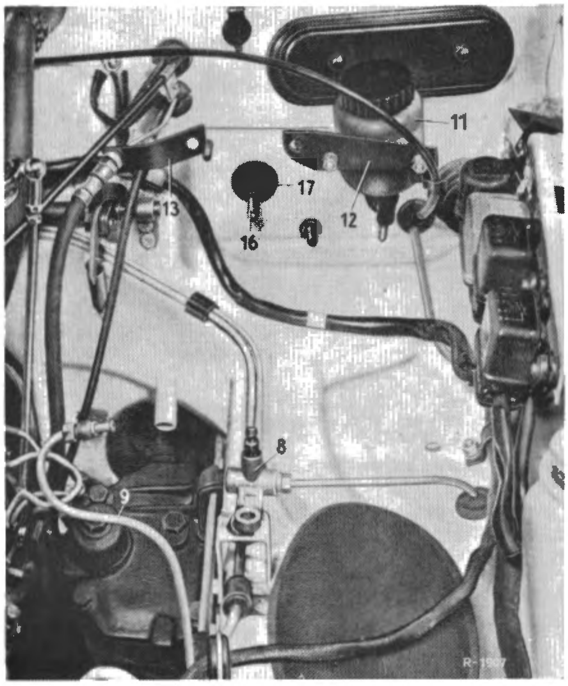


Fig. 29-2/9

8 Distributor fitting
9 Brake line
11 Reservoir for supply cylinder
12 Bracket for reservoir
13 Bracket for oil pressure gage line
16 Push rod on brake pedal
17 Rubber sleeve

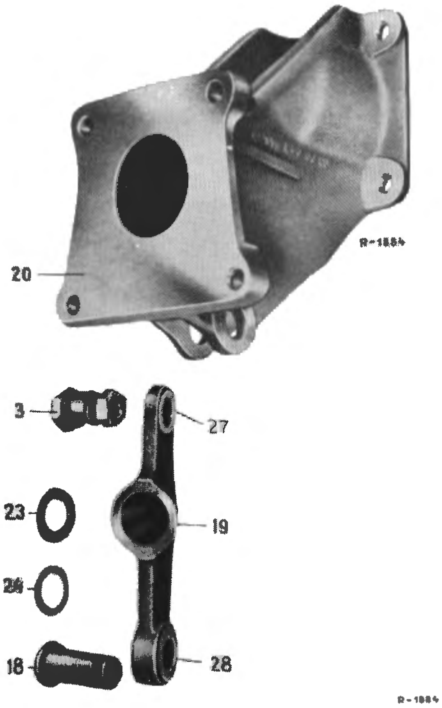


Fig. 29-2/10

3 Adjusting screw with hexagon nut and lock washer
18 Collar bolt
19 Relay lever
20 Bearing bracket
23 Spring washer
24 Washer
27 Bushing
28 Bushing

3. Pull the cotter pin out of the collar bolt (18) and remove the collar bolt together with the washers (23) and (24), and the relay lever (19) (Fig. 29-2/10).

4. Check the bushings (27) and (28) in the relay lever (19) and, if necessary, replace and ream to the prescribed dimension (see Job No. 29-0 and Fig. 29-2/10).

Installation:

5. Lightly coat the collar bolt with Molykote paste Type G and install the lever in the bearing bracket.

Note: The spring washer is placed between the head of the collar bolt and the bearing bracket.

6. Put on the washer (24) and secure the collar bolt by means of the cotter pin (Fig. 29-2/10).

7. Install the bearing bracket and attach the power brake together with the tandem master cylinder to the bearing bracket.

8. Adjust the brake pedal travel and the contact point of the mechanical stop light switch (see Job No. 42-20).

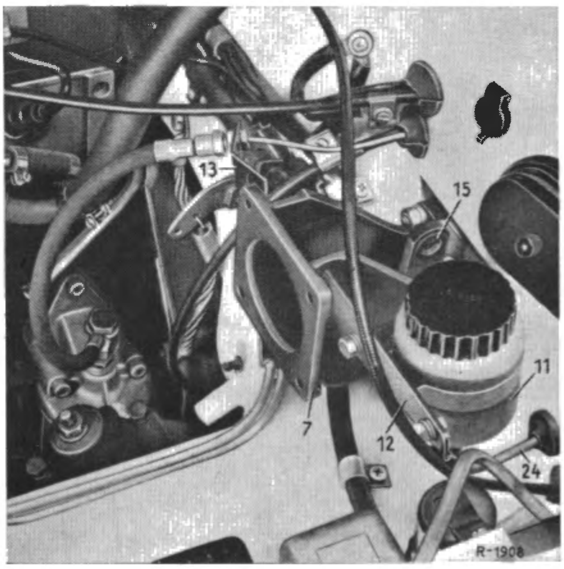


Fig. 29-2/11

7 Bearing bracket
11 Reservoir for supply cylinder
12 Bracket for reservoir
13 Bracket for oil pressure gage line
15 Relay lever
24 Line from reservoir to supply cylinder

Job No.
29-3

Supply Cylinder

Modification: Supply Cylinder for Models 190 c and 190 Dc (Addition)

A. General

The construction of the supply cylinder with its fluid reservoir is similar to that of a brake master cylinder. Since the hydraulic clutch actuating mechanism does not require any residual pressure, the supply cylinders have no check valve.

1st Version Supply Cylinder for Models 220 b, 220 Sb and 220 SEb Sedan

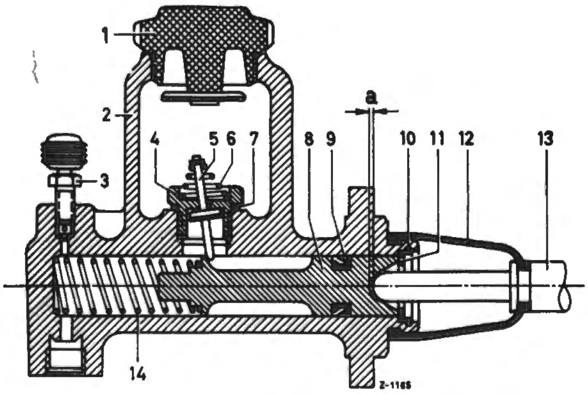


Fig. 29-3/1

1 Screw cap
2 Fluid reservoir
3 Bleed screw
4 Tilting valve
5 Pin in tilting valve
6 Spring of tilting valve
7 Sealing ring
8 Piston
9 Grooved cup
10 Snap ring
11 Stop washer
12 Protective cap
13 Piston rod (46 mm long)
14 Pressure spring
a = Clearance between piston and piston rod

The 1st version of the supply cylinder is provided with a tilting valve (4) and has no compensating port. The piston (8) has a grooved cup (9) (Fig. 29-3/1).

The length L of the piston rod is 46 mm (Fig. 29-3/5).

2nd Version Supply Cylinder for Models 220 b, 220 Sb and 220 SEb Sedan

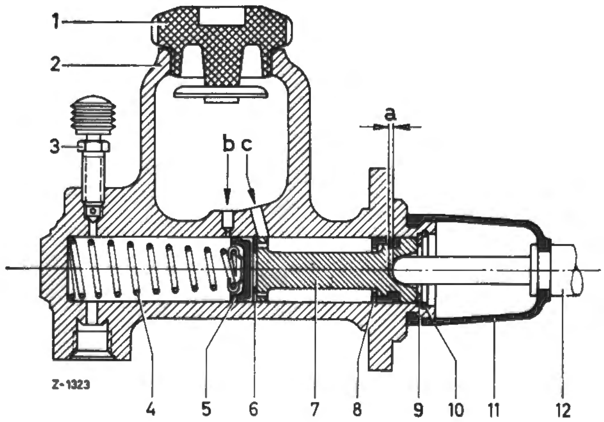


Fig. 29-3/2

1 Screw cap
2 Fluid reservoir
3 Bleed screw
4 Pressure spring
5 Primary cup
6 Piston cup washer
7 Piston
8 Secondary cup
9 Stop washer
10 Snap ring
11 Protective cap
12 Piston rod (46 mm long)
a = Clearance between piston and piston rod
b = Compensating port
c = Connecting port

Like the brake master cylinder the 2nd version of the supply cylinder contains a compensating port (b) and a connecting port (c). When the clutch pedal is released, the primary cup must not cover the compensating port, which would prevent the brake fluid from returning to the fluid reservoir when it heats up and expands. The primary cup (5) and the secondary cup (8) are on the piston and there is a piston cup washer (6) between the piston and the primary cup (Fig. 29-3/2).

The length L of the piston rod in this supply cylinder is also 46 mm (Fig. 29-3/5).

3rd Version Supply Cylinder for Models 220 b, 220 Sb and 220 SEb Sedan

1st Version Supply Cylinder for Model 220 SEb Coupé B

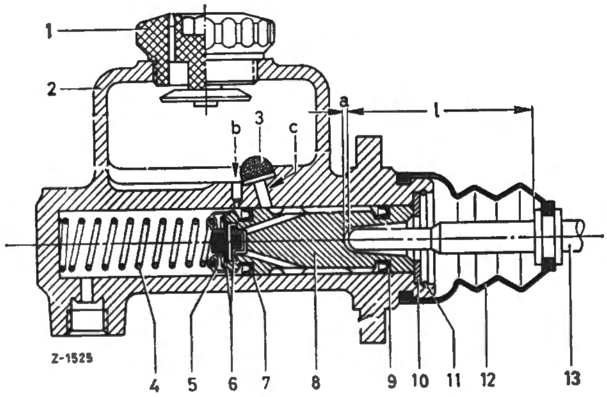


Fig. 29-3/3

1 Screw cap
2 Fluid reservoir
3 Screen
4 Pressure spring
5 Cap
6 Valve
7 Primary cup
8 Piston
9 Secondary cup
10 Stop washer
11 Snap ring
12 Protective cap (bellows-type)
13 Piston rod (56 mm long)
a = Clearance between piston and piston rod
b = Compensating port
c = Connecting port
L = Length of piston rod

The construction of this supply cylinder is similar to that of the 2nd version except that the piston (8) is provided with a valve (6). When the clutch pedal returns quickly to its release position, this valve ensures that the space in front of the piston is quickly refilled with brake fluid so that no air can enter the hydraulic system via the extraction cylinder (Fig. 29-3/3).

The length L of the piston rod is 56 mm (Fig. 29-3/5).

Note: Recent models of this supply cylinder are also provided with a bleed screw.

1st Version Supply Cylinder for Models 190 c and 190 Dc

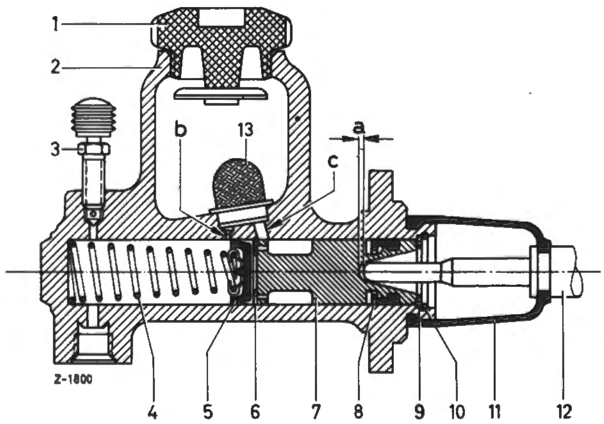


Fig. 29-3/4

1 Screw cap
2 Fluid reservoir
3 Bleed screw
4 Pressure spring
5 Primary cup
6 Piston cup washer
7 Piston
8 Secondary cup
9 Stop washer
10 Snap ring
11 Protective cap
12 Piston rod (56 mm long)
13 Screen
a = Clearance between piston and piston rod
b = Compensating port
c = Connecting port

The supply cylinder is similar to that of the 2nd version for Models 220 b, 220 Sb and 220 SEb Sedan. Only the piston (7) and the piston rod (12) have been modified (Fig. 29-3/5).

The length L of the piston rod is 56 mm (Fig. 29-3/5).

Piston Rod

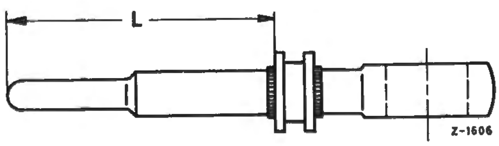
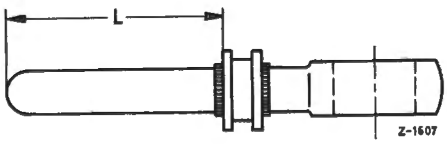


Fig. 29-3/5

Piston rod for supply cylinder
2nd version
L = 56 mm



Piston rod for supply cylinder
1st version
L = 46 m

Inside Supply Cylinder for Models 190 c and 190 Dc

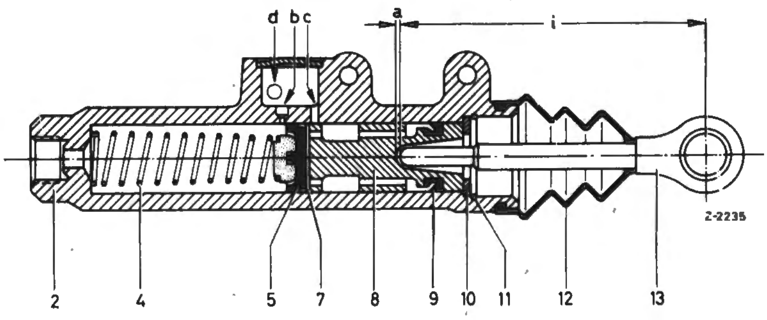


Fig. 29-3/6

2 Housing
4 Pressure spring
5 Primary cup
7 Piston cup washer
8 Piston
9 Secondary cup
10 Stop washer
11 Snap ring
12 Protective cap
13 Piston rod
a = Clearance between piston and piston rod
b = Compensating port
c = Connecting port
d = Intake port from reservoir
l = Length of piston rod

The design of the supply cylinder is the same as the 2nd version supply cylinder (see Fig. 29-3/2). Since the supply cylinder is attached to the pedal support, the reservoir was arranged separately. The length "L" of the piston rod is 100 mm.

Inside Supply Cylinder for Models 220 b, 220 Sb, 220 SEb, and 230 SL

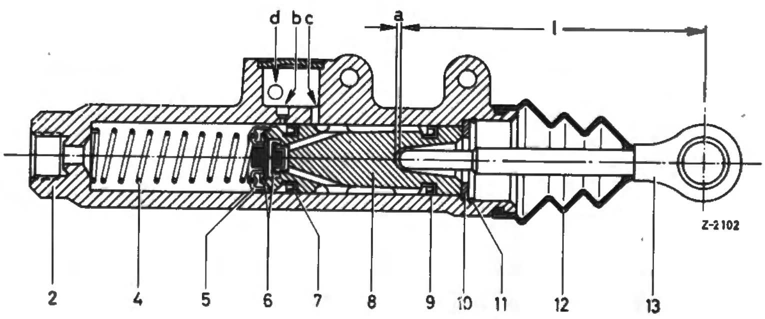


Fig. 29-3/7

2 Housing
4 Pressure spring
5 Cap
6 Valve
7 Primary cup
8 Piston
9 Secondary cup
10 Stop washer
11 Snap ring
12 Protective cap
13 Piston rod
a = Clearance between piston and piston rod
b = Compensating port
c = Connecting port
d = Intake port from reservoir
l = Length of piston rod

The design of the supply cylinder is the same as the 3rd version supply cylinder (Fig. 29-3/3). Since the supply cylinder is attached to the pedal support, the reservoir was arranged separately. The length "L" of the piston rod is 100 mm.

B. Removal and Installation of Outside Supply Cylinder

Removal:

1. After removing the battery, pump the brake fluid from the fluid reservoir of the supply cylinder via the bleed screw (6) of the extraction cylinder (5) (Fig. 29-4/4).

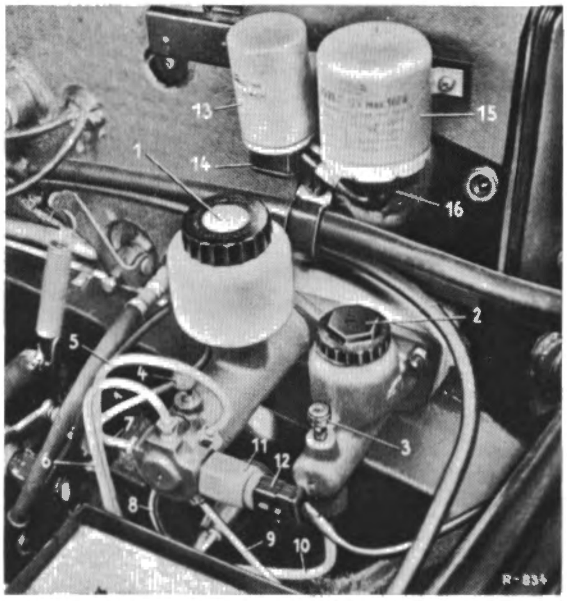


Fig. 29-3/8

1 Screw cap of brake master cylinder
2 Screw cap of supply cylinder
3 Bleed screw of supply cylinder
4 Bleed screw of brake master cylinder
5 Brake line
6 Brake line
7 Brake line
8 Brake line
9 Brake line
10 Line from supply cylinder to extraction cylinder
11 Stop light switch
12 Plug connection
13 Flash direction signal
14 Plug connection
15 Upper beam flash signal
16 Plug connection

2. Detach the line (10) at the supply cylinder and unscrew the supply cylinder from the intermediate flange and the cowl (Fig. 29-3/8).

Note: To prevent dirt from entering the system close the opening in the supply cylinder with a dummy plug and close the line with a rubber cap.

Installation:

3. When reinstalling the supply cylinder please note that the piston rod for the 3rd version is shouldered and measures 56 mm up to the collar whereas the piston rod for the 1st and 2nd version supply cylinders is cylindrical and measures 46 mm up to the collar (see Fig. 29-3/4).

4. Check and adjust the clearance between the piston rod and the piston of the supply cylinder (see Job No. 29-6).

5. Check and adjust the free play of the push rod of the extraction cylinder until the throw-out bearing rests against the release levers of the pressure plate (see Job No. 29-6).

6. Bleed the hydraulic system and check for leaks.

C. Removal and Installation of Inside Supply Cylinder

Removal:

1. Pump the brake fluid out of the reservoir of the supply cylinder via the bleed screw (6) of the extraction cylinder (5) (Fig. 29-4/4).

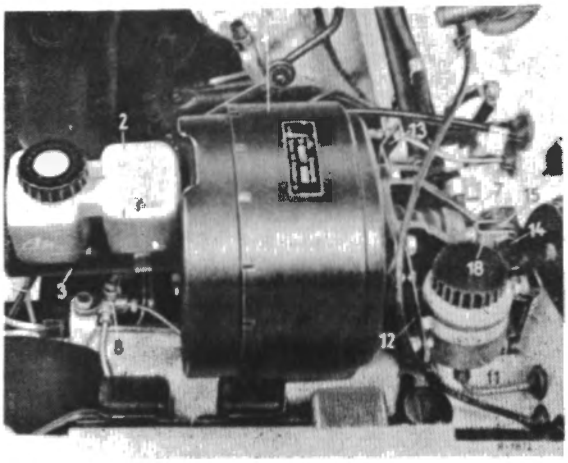


Fig. 29-3/9

1 Power brake
2 Reservoir of tandem master cylinder
3 Tandem master cylinder
7 Bearing bracket
8 Distributor fitting
9 Brake line to rear wheel brake
11 Reservoir for supply cylinder
12 Reservoir bracket
13 Bracket for oil pressure gage line
14 Adjusting screw with lock washer and hexagon nut
15 Relay lever
18 Piston rod of power brake

Fig. 29-3/10

1 Clutch pedal
2 Brake pedal
3 Cover plate
4 Pipe clip
5 Line to extraction cylinder
6 Hexagon screw with lock washer and washer
7 Steering column jacket
8 Tightening strap
9 Opening in steering column jacket for clamp ring
10 Mechanical stop light switch
11 Stop ring
12 Supply cylinder
13 Line from reservoir
14 Piston rod
15 Pressure spring (dead center spring)
16 Hexagon screw with lock washer
17 Stop screw
18 Control lever
19 Plastic plate
20 Hexagon nut
21 Foot brake
22 Bracket

2. Detach the connecting line (13) from the reservoir on the supply cylinder (12). Also detach the line (5) to the extraction cylinder (Fig. 29-3/10).

3. Unscrew the supply cylinder (12) from the pedal support (Fig. 29-3/10).

Note: To prevent dirt from entering the system, close the opening in the supply cylinder with a dummy plug and close the line with a rubber cap.

Installation:

4. Fasten the supply cylinder to the pedal support.

5. Attach the connecting line from the reservoir and the line for the extraction cylinder to the supply cylinder.

6. Check and adjust the clearance between the piston rod and the piston of the supply cylinder (see Job No. 29-6).

7. Check and adjust the free play of the push rod of the extraction cylinder until the throw-out bearing rests against the release levers of the pressure plate (see Job No. 29-6).

8. Bleed the hydraulic system and check for leaks.

Removal and Installation of Extraction Cylinder

Job No.
29-4

Modification: Model 300 SE added

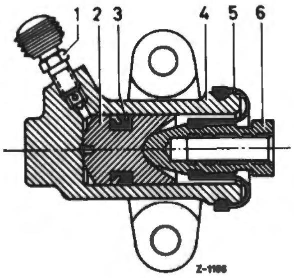


Fig. 29-4/1
1st Version
1 Bleed screw
2 Piston
3 Grooved cup
4 Housing
5 Protective cap (roll-type)
6 Pressure pin (length 38 mm)

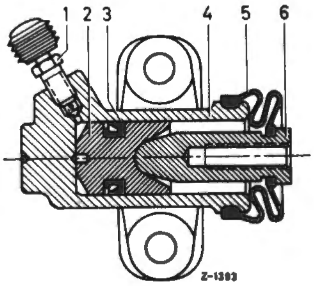


Fig. 29-4/2
2nd Version
1 Bleed screw
2 Piston
3 Grooved cup
4 Housing
5 Protective cap (bellows-type)
6 Pressure pin (length 45 mm)

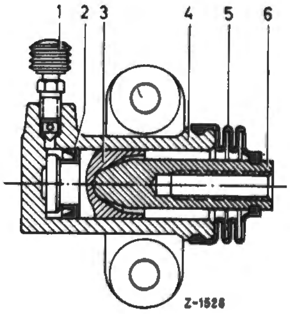


Fig. 29-4/3
3rd Version
1 Bleed screw
2 Grooved cup
3 Piston
4 Housing
5 Protective cap (bellows-type)
6 Pressure pin (length 53 mm)

When removing and installing the extraction cylinder please give attention to the following points:

1. Originally the extraction cylinder was fastened to the clutch housing (2) by means of hexagon screws (1) (Fig. 29-4/7). If on cars of this type the thread in the clutch housing has been damaged, Heli-Coil threaded adapters M 8 × 12 can be inserted instead. On new models the extraction cylinder is fastened to the clutch housing by means of two stud bolts (1) (Fig. 29-4/8).

Note: On Model 300 SE with mechanical transmission the extraction cylinder is attached to the clutch housing by means of a snap ring (13). The noses of the snap ring, which are under slight tension, must point towards the clutch housing when installed (Fig. 29-4/9).

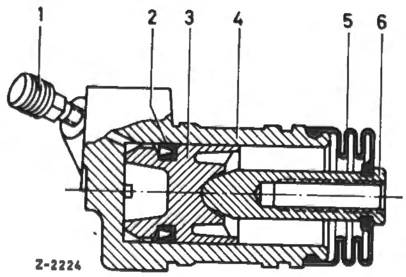


Fig. 29-4/4

1 Bleed screw
2 Grooved cup
3 Piston
4 Housing
5 Protective cap (bellows-type)
6 Pressure pin

2. Check the protective cap (5) of the extraction cylinder. Damaged protective caps must be replaced. Instead of the roll-type protective cap only bellows-type caps should be installed (Figs. 29-4/1 and 29-4/2).

Note: a) If on a 1st version extraction cylinder the roll-type protective cap (3) is replaced by a bellows-type protective cap (3), it is necessary at the same time to install the longer pressure pin (7) and the shorter push rod (5). (Figs. 29-4/7 and 29-4/8).

b) A small number of cars were supplied with the 2nd version extraction cylinder and the long push rod. **It is imperative that on these cars the shorter push rod should be installed subsequently.** The hexagon nut SW 12 for adjusting the push rod has been replaced in the 2nd version by a parallel flat SW 6.

c) The shorter push rod (5) must also be installed in the 3rd version extraction cylinder (Fig. 29-4/7).

3. After installing the extraction cylinder bleed the hydraulic system, adjust the clutch pedal free play, and check the hydraulic system for leaks.

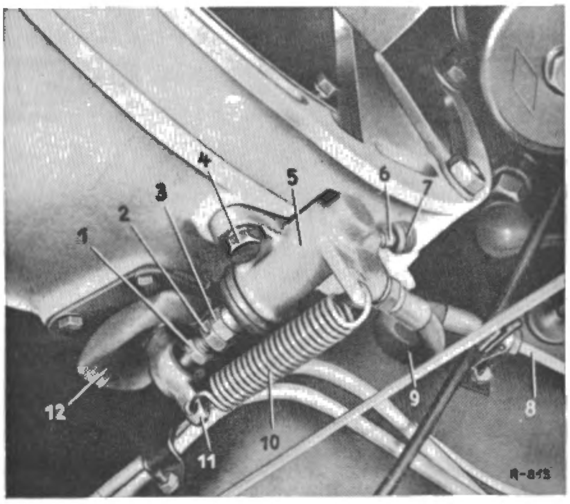


Fig. 29-4/5
1st Version

1 Push rod
2 Hexagon nut
3 Pressure pin
4 Hexagon screw
5 Extraction cylinder
6 Bleed screw
7 Protective cap
8 Line
9 Hose
10 Return spring
11 Throw-out fork
12 Cuff

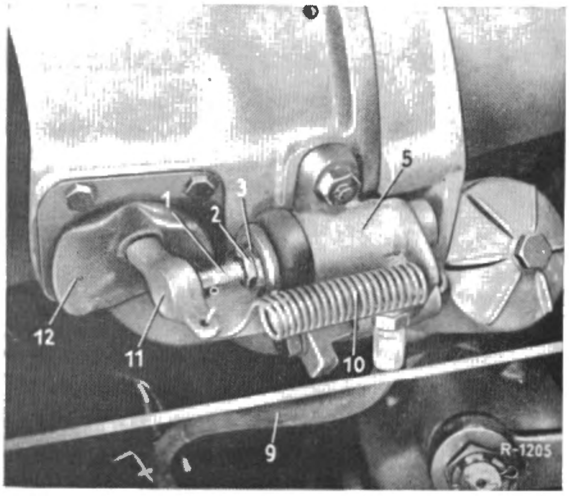


Fig. 29-4/6
2nd Version

1 Push rod
2 Hexagon nut
3 Pressure pin
5 Extraction cylinder
9 Hose
10 Return spring
11 Throw-out fork
12 Cuff

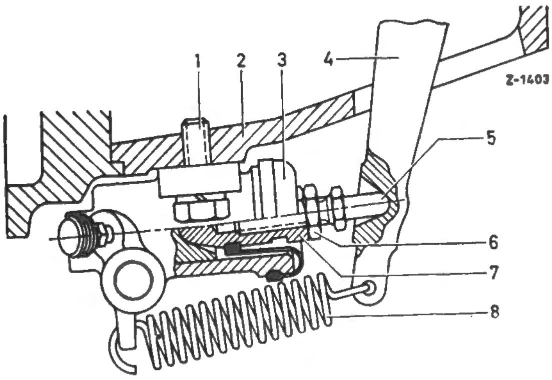


Fig. 29-4/7
1st Version

1 Hexagon screw
2 Clutch housing
3 Protective cap (roll-type cuff)
4 Throw-out fork
5 Push rod (length 49 mm)
6 Hexagon nut
7 Pressure pin (length 38 mm)
8 Return spring (1st Version)

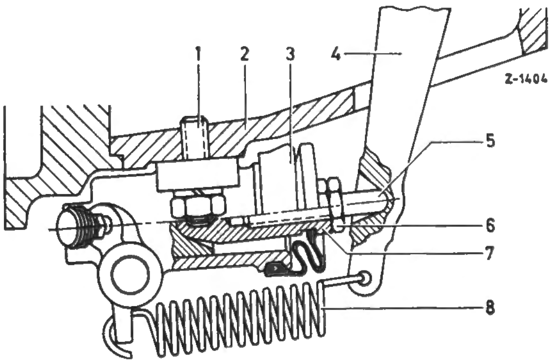


Fig. 29-4/8
2nd and 3rd Version

1 Stud bolt
2 Clutch housing
3 Protective cap (bellows-type cuff)
4 Throw-out fork
5 Push rod (length 43 mm)
6 Hexagon nut
7 Pressure pin (length 45 mm or 53 mm)
8 Return spring (2nd version)

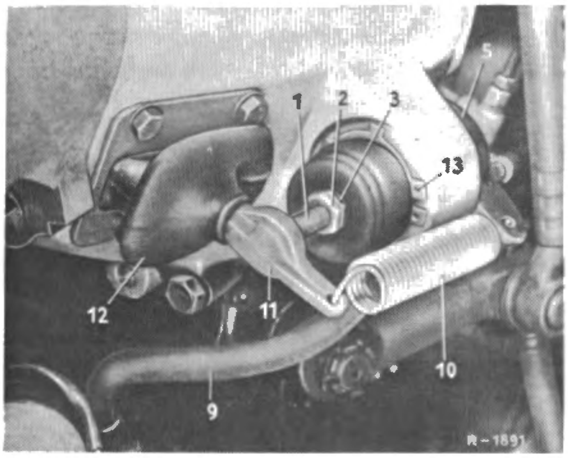


Fig. 29-4/9

Arrangement on Model 300 SE with mechanical transmission

1 Push rod
2 Hexagon nut
3 Pressure pin
5 Extraction cylinder
9 Hose
10 Return spring
11 Throw-out fork
12 Cuff
13 Snap ring

Important: When installing a new extraction cylinder make sure that the flange of the cylinder rests properly against the clutch housing (2); however the extraction cylinder housing must not touch the clutch housing or the intermediate flange at any point (Fig. 29-4/7). The minimum distance between the extraction cylinder and the clutch housing or the intermediate flange should be 1 mm. This distance can easily be checked by means of an approx. 1 mm. thick cardboard strip. If the distance is found to be smaller than 1 mm. the clutch housing and the intermediate flange must be reconditioned. If the extraction cylinder bears against the clutch housing or the intermediate flange the result after a short time will be stiffness in the clutch actuating mechanism and failure of the extraction cylinder itself.

Job No.
29-5

Bleeding of the Hydraulic System of the Clutch Actuating Mechanism

Modification: Note to Para 2 added

1. Unscrew the screw cap (2) of the reservoir and if necessary fill up with brake fluid.

2. First bleed the supply cylinder by means of the bleed screw (3) (Fig. 29-5/1) and then the extraction cylinder by means of the bleed screw (6) (Fig. 29-5/2).

Note: On cars with inside supply cylinder please note the following points:
Cars of Models 190 c and 190 Dc can only be bled from below by means of a bleeding device and via the opened bleed screw on the extraction cylinder.
When a bleeding device is used, the pressure should not exceed 0.5 atm since a higher pressure might force off the hose plug connection on the reservoir and the scattered brake fluid would damage the paint.
When the bleeding device is used to bleed from above, the clutch pedal should be completely depressed since otherwise the air between the primary and secondary cup in the supply cylinder might not be removed completely.
The supply cylinder need not be bled since it is not provided with a bleed screw.
When the system is bled without the use of a bleeding device, the bleed screw on the extraction cylinder must be closed before the clutch pedal is released in order to avoid the shuttling of an air pad in the lines.

3. Bleed the system until the brake fluid in the glass container is free from air bubbles.
Then close the bleed screws again, taking care to ensure that the clutch pedal is fully depressed and is held in this position.

4. Check the fluid level in the reservoir and if necessary top up.

Note: Make sure that the vent bore in the screw cap of the supply cylinder is not obstructed.

5. Then depress the clutch pedal several times, always releasing the pedal with a jerk.

6. Check the whole system for leaks.

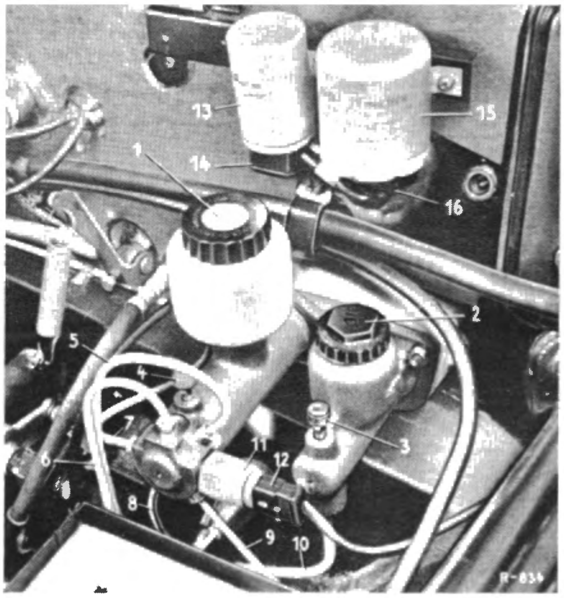


Fig. 29-5/1

1 Screw cap (master cylinder)
2 Screw cap (supply cylinder)
3 Bleed screw
4 Bleed screw
5 Brake line
6 Brake line
7 Brake line
8 Brake line
9 Brake line
10 Line
11 Stop light switch
12 Plug connection
13 Flash signal mechanism
14 Plug connection
15 Upper beam flash mechanism
16 Plug connection

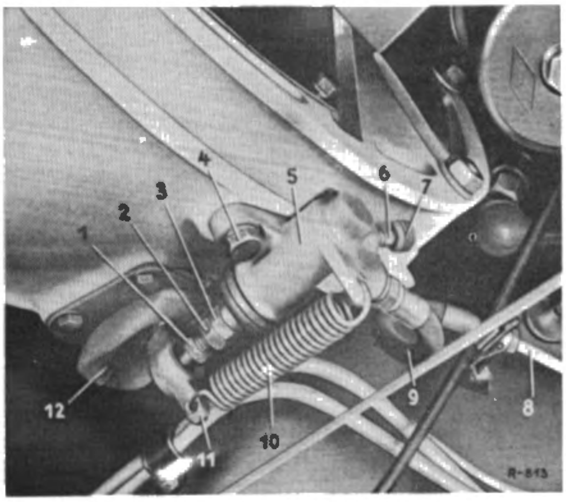


Fig. 29-5/2

1 Push rod
2 Hexagon nut
3 Pressure pin
4 Hexagon screw
5 Extraction cylinder
6 Bleed screw
7 Protective cap
8 Line
9 Hose
10 Return spring
11 Throw-out fork
12 Cuff

Adjustment of the Hydraulic Clutch Actuating Mechanism

Job No.
29-6

Modification: Inside Supply Cylinder added

In the case of the hydraulic clutch actuating mechanism, the clearance between the piston rod and the piston of the supply cylinder and also the free play between the push rod of the extraction cylinder and the throw-out bearing at the release levers of the clutch must be checked and adjusted.

A. Adjusting the Clearance of the Piston Rod at the Supply Cylinder

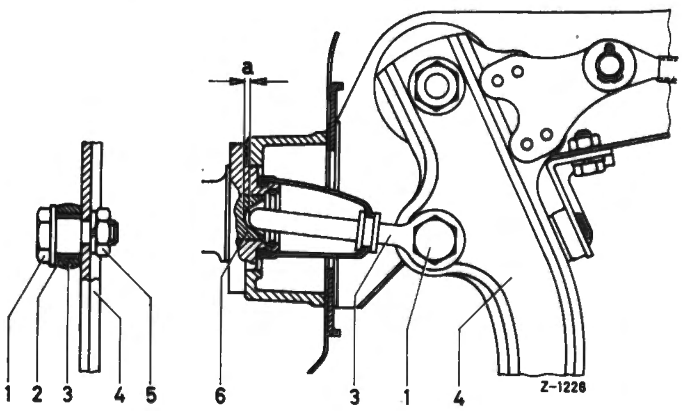


Fig. 29-6/1

Outside supply cylinder

1 Adjusting screw
2 Bushing in piston rod
3 Piston rod
a = clearance between piston and piston rod
4 Clutch pedal
5 Hexagon nut
6 Piston

1. Loosen the hexagon nut (5) of the adjusting screw (1). Then turn the adjusting screw until the piston rod (3) has the clearance "a". 0.2-0.5 mm in relation to the piston (6) of the supply cylinder. This clearance cannot be measured, it must be adjusted by touch.

Note: The head of the adjusting screw is provided with a line marking in the direction of maximum eccentricity. When adjusting the screw make sure that **on cars with outside supply cylinder** this line marking points in the direction of the pivot pin for the pedals, and that **on cars with inside supply cylinder** it points toward the rear.

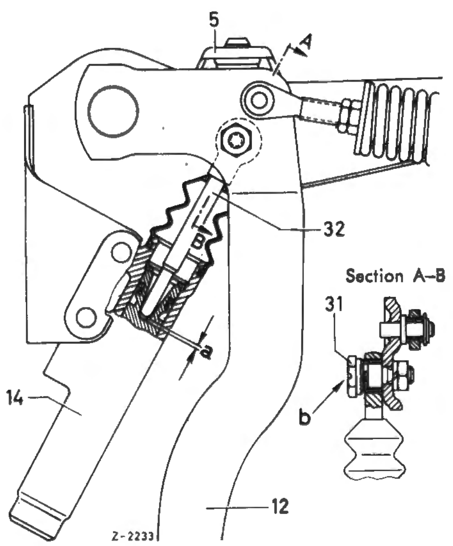


Fig. 29-6/2

5 Rubber stop for clutch pedal
12 Clutch pedal
14 Supply cylinder
31 Adjusting screw with hexagon nut and lock washer
32 Piston rod
a = Clearance between piston and piston rod
b = Line marking

2. If the clearance "a" is not maintained, the primary cup may cover the compensating port in the supply cylinder, which would make compensation of brake fluid between fluid reservoir and hydraulic system impossible (see Job No. 29-0).

B. Adjusting the Free Play of the Push Rod at the Extraction Cylinder

1. Detach the return spring (10) from the throw-out fork (11) and the extraction cylinder (5).

2. Push the throw-out fork back until the throw-out bearing rests against the release levers.

3. Check the clearance between the throw-out fork and the extraction cylinder push rod in this position of the individual units and if necessary correct by adjusting the push rod (1). To do this loosen the hexagon nut (2) and adjust the push rod to the correct length (for dimensions see Job No. 29-0).

4. Attach the return spring to the extraction cylinder and the throw-out fork.

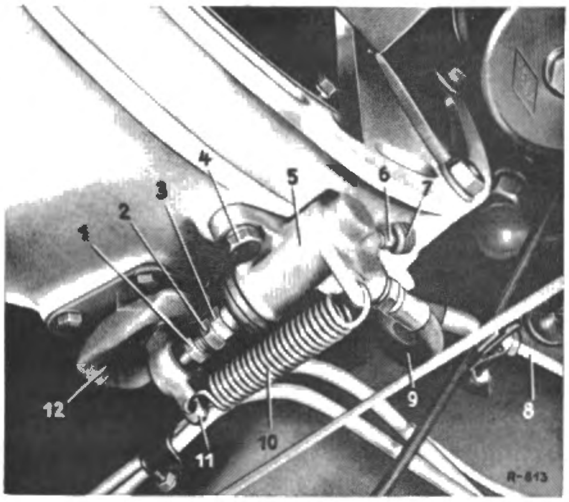


Fig. 29-6/3

Extraction cylinder 1st version

1 Push rod
2 Hexagon nut
3 Pressure pin
4 Hexagon screw
5 Extraction cylinder
6 Bleed screw
7 Protective cap
8 Line from supply cylinder
9 Pressure hose
10 Return spring
11 Throw-out fork
12 Cuff

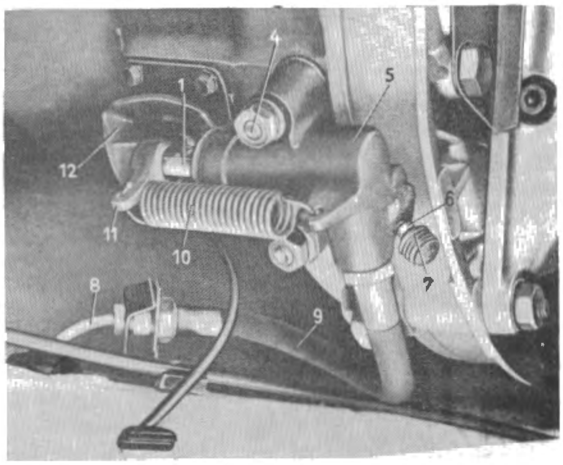


Fig. 29-6/4

Extraction cylinder 2nd version

1 Push rod
4 Stud screw
5 Extraction cylinder
6 Bleed screw
7 Protective cap
8 Line from supply cylinder
9 Pressure hose
10 Return spring
11 Throw-out fork
12 Cuff

Adjustment of Accelerator Pedal

Job No. 30-3

Modification: Models 190 c, 190 Dc and 300 SE (added)

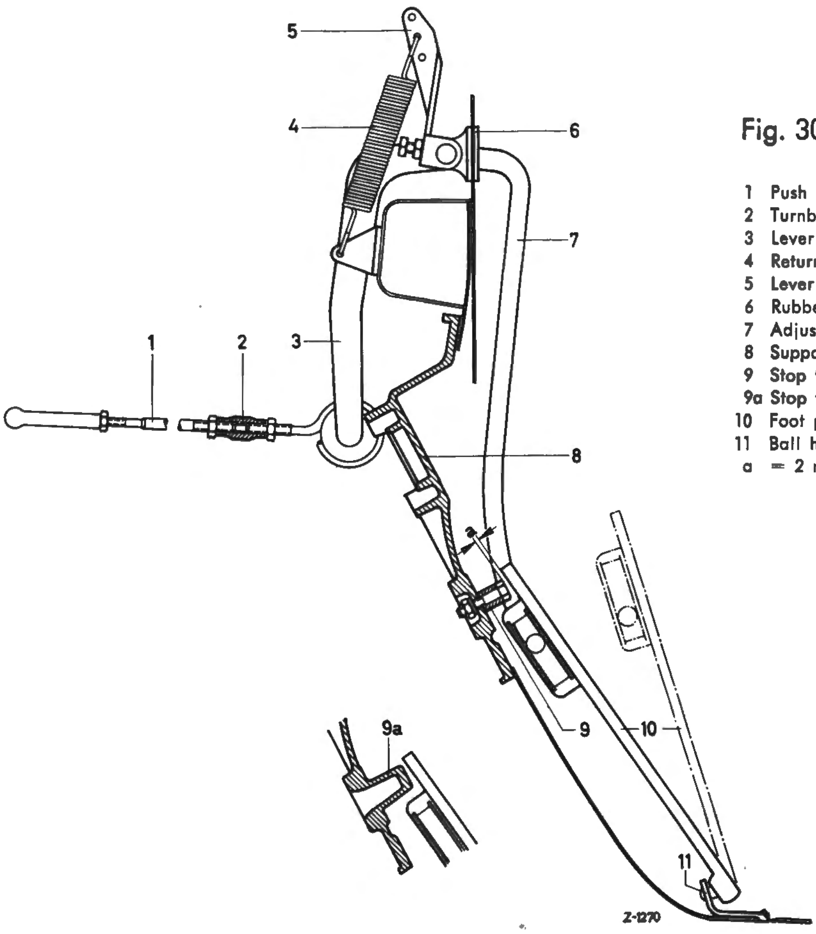


Fig. 30-3/1

1 Push rod
2 Turnbuckle
3 Lever on control shaft
4 Return spring
5 Lever for return spring
6 Rubber grommet
7 Adjustment lever
8 Support plate for steering column jacket
9 Stop for foot plate (1st version)
9a Stop for foot plate (2nd version)
10 Foot plate
11 Ball head bracket
a = 2 mm

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb with Mechanical Transmission

1. Insert a gage 2 mm thick between the foot plate (10) and the stop (9 or 9a). Use a suitable fixture to fix the foot plate in the full-load position (Fig. 30-3/1).

2. Adjust the length of the push rod (1) by means of the turnbuckle (2) in such a way that the throttle valve levers of the carburetors or the throttle valve lever of the venturi control unit rest against the full-load stop.

3. Lock the turnbuckle in its position by means of the hexagon nuts.

4. Return the foot plate to idle position and remove the gage.

5. Depress the accelerator pedal. If the adjustment is correct, the stop (9 or 9a) must be noticeable when the pedal is depressed beyond the full-load position.

Models 300 SE, 220 SEb, with Automatic Transmission

1. Depress the foot plate (6) until it bears against the kickdown switch (4) (position B, Fig. 30-3/3). In this position there must be 5 mm clearance between the throttle valve lever (1) and the full load stop (2) on the venturi control unit (Fig. 30-3/2). If necessary adjust the kickdown switch (4) after loosening the lock nut (3) by turning it in or out in the cover plate (2) in the steering column jacket (Fig. 30-3/3).

If the adjustment range of the kickdown switch is not sufficient, turn the turnbuckle (2) on the control rod (1) (Fig. 30-3/1).

2. Depress the accelerator pedal to the kickdown position (position C). In this position there should be a clearance of about 1 mm between the throttle valve lever and the full load stop on the venturi control unit.

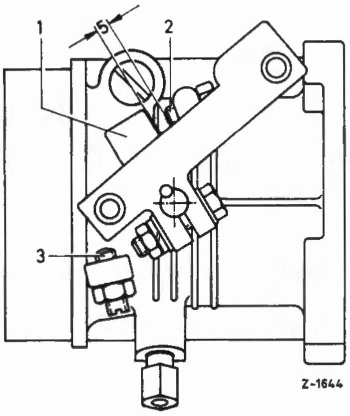


Fig. 30-3/2

1 Throttle valve lever
2 Full load stop
3 Idle stop

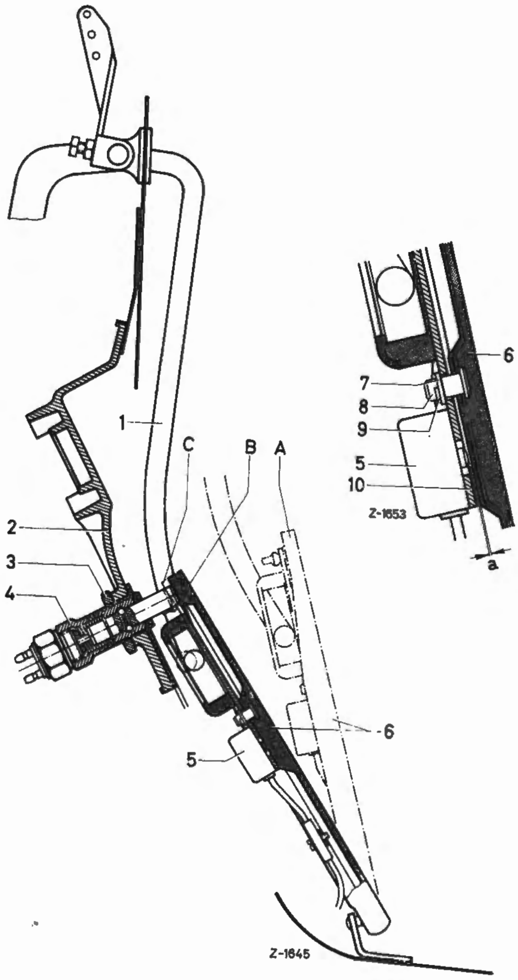


Fig. 30-3/3

1 Adjustment lever
2 Cover plate
3 Lock nut
4 Kickdown switch
5 Lifting switch (Idle switch)
6 Foot plate
7 Compensating washer
8 Bolt
9 Cotter pin
10 Plate
A Idle position
B Full load position
C Kickdown position

Springs and Shock-Absorbers

Group 32

Springs and Shock-Absorbers

General Data, Dimensions, and Tolerances

Modification: Models 190 c, 190 Dc, and 300 SE added.
*Other Modifications are marked **

A. Tables Showing Permissible Combinations of Front Springs – Rear Springs – Compensating Springs – Shock Absorbers

Cars with 1st Version Front Axle Support*

Model 220 b up to Chassis End No. 023 660
Model 220 Sb up to Chassis End No. 049 855
Model 220 SEb Sedan up to Chassis End No. 016 975
Model 220 SEb Coupé up to Chassis End No. 016 938

Model	Front Spring Part No.	Associated front shock absorber Designation Part No.	Rear Spring Part No.	Compensating Spring Part No.	Associated rear shock absorber Designation Part No.
Standard Springs					
220 b	111 321 09 04	Bilstein Type B 36-001 111 323 04 00[6]) 111 323 08 00[7]) 111 323 09 00[8]) Replacement for Models 220 b, Sb 110 323 07 00 Replacement for Model 220 SEb 111 323 17 00	110 324 10 04	110 329 04 01	Bilstein Type B 46-011 000 326 82 00 Replacement for Models 220 b, Sb 110 326 11 00 Replacement for Model 220 SEb 111 326 01 00
220 S b	111 321 08 04[1]) 111 321 09 04[2])				
220 SE b Sedan	111 321 11 04[3]) 111 321 12 04[4]) 111 321 13 04[5])				
220 SE b Coupé	111 321 12 04	Bilstein Type B 36-001 111 323 09 00 Replacement 111 323 17 00			
Harder Shock-Absorbers (only for Subsequent Installation)					
220 S b 220 SE b	standard	Bilstein Type B 36-001 111 323 10 00 Replacement 111 323 17 00	standard	standard	Bilstein Type B 46-001 111 326 00 00 Replacement 111 326 01 00
Special Version: Harder Springs for Bad Road Conditions					
220 b 220 S b 220 SE b Sedan and Coupé	111 321 10 04	Stabilus T 35×210 111 323 07 00 Replacement Bilstein Type B 36-001 111 323 17 00	110 324 12 04	110 329 05 01	Stabilus T 50×205/19 110 326 02 00[11]) Replacement Bilstein Type B 46-001 111 326 01 00[11])
Special Version: Harder Springs for Police Radio Cars (For Ordinary Road Conditions)[10])					
220 b 220 S b 220 SE b Sedan	111 321 10 04	standard or Bilstein Type B 36-001 111 323 10 00 Replacement 111 323 17 00	110 324 12 04	110 329 05 01	standard or Bilstein Type B 46-001 111 326 00 00 Replacement 111 326 01 00

Note: When installing the springs, please check with the Tables "Springs, Corresponding Color Code".
For footnotes see page 32-0/2.

Footnotes to Table on page 32-0/1

[1]) 1st version; installed as standard part up to Chassis End No. 017 497.

[2]) 2nd version; installed as standard part as from Chassis End No. 017 498.
These front springs can be installed subsequently in cars up to Chassis End No. 017 497 if a slightly harder spring system is required. If 1st or 2nd version front springs are installed (see Table "Test Values"), it is necessary to increase the height of the specified rubber washer (see Table "Front Springs, Corresponding Color Code") by installing a rubber washer of 3 mm thickness. This is necessary in order to obtain a correct control arm position of the front axle.
Since it is not permissible for the rubber washer to exceed a height of 12 mm, the following instructions for the subsequent installation of 1st and 2nd version springs must be observed: In the case of Sedans and Sedans with sliding roof use only springs with red and blue color code, and in the case of Sedans with sliding roof and automatic clutch use only springs with a blue color code. When 3rd version springs (see Table "Test Values") are used, the rubber washers specified in the Table "Front Springs, Corresponding Color Code" can be used.
On Model 220 Sb the front springs Part No. 111 321 09 04 should be installed subsequently only together with the 2nd or 3rd version shock absorbers. (Part Nos. 111 323 08 00 or 111 323 09 00).

[3]) 1st version; installed as standard part up to Chassis End No. 001 938.

[4]) 2nd version; installed as standard part from Chassis End Nos. 001 939 to 003 029.

[5]) 3rd version; installed as standard part as from Chassis End No. 003 030.

[6]) 1st version; installed as standard part up to Chassis End Nos. Model 220 b 007 487 Model 220 Sb 016 036 Model 220 SEb 004 363.

[7]) 2nd version; installed as standard part as from Chassis End Nos. Model 220 b 007 488 Model 220 Sb 016 037 Model 220 SEb 004 364.

[8]) 3rd version; installed as standard part as from Chassis End Nos. Model 220 b 014 655 Model 220 Sb 029 783 Model 220 SEb 009 457.

[9]) The harder front spring Part No. 111 321 12 04 which is installed on Model 220 SEb Coupé as a standard part can be subsequently installed on Models 220 b, and 220 SEb Sedan on request.

[10]) This combination can also be used for special purposes when the car is regularly driven with a very high trunk compartment load.

[11]) Shock-absorbers should always be mounted with dustprotectors.

Cars with 2nd Version Front Axle Support

*Modification: Model 230 SL added. Other modifications are marked with an asterisk**

Model 220 b as from Chassis End No. 023 661
Model 220 Sb as from Chassis End No. 049 856
Model 220 SEb Sedan as from Chassis End No. 016 976
Model 220 SEb Coupé as from Chassis End No. 016 939

Model	Front Spring Part No.	Associated front shock absorber Designation Part No.	Rear Spring Part No.	Compensating Spring Part No.	Associated rear shock absorber Designation Part No.
Standard Springs					
190 c	**110 321 08 04**	Bilstein Type B 36-001 110 323 04 00[1]) 111 323 11 00[2]) **110 323 07 00[3])**	110 324 10 04[1]) **110 324 26 04[2])**	**110 329 04 01[7])***	Bilstein Type B 46-011 001 326 00 00[1]) 001 326 01 00[2]) **110 326 11 00[3])**
190 Dc	**111 321 15 04**				
220 b 220 Sb		Bil. Type B 36-001 111 323 11 00[1]) **110 323 07 00[2])**			Bil. Type B 46-011 001 326 01 00[1]) **110 326 11 00[2])**
220 SEb Sedan		Bilstein Type B 36-001 111 323 11 00[1]) 111 323 13 00[2]) **111 323 17 00[3])**			Bilstein Type B 46-011 001 326 01 00[1]) 001 326 05 00[2])[4]) **111 326 01 00[3])**
220 SEb/C	111 321 16 04[1]) **111 321 18 04[2])**				
230 SL	**110 321 08 04**	Bilstein Type B 36-001 **113 323 00 00**	**113 324 03 04**	**113 329 03 01**	Bilstein Type B 46-011 113 326 00 00
Harder Shock-Absorber (only for Subsequent Installation)					
190 c 190 Dc 220 b 220 Sb	standard	Bilstein Type B 36-001 111 323 13 00[1]) **111 323 17 00[2])**	standard	standard	Bilstein Type B 46-011 001 326 05 00[1])[4]) **111 326 01 00[2])**
Special Version: Harder Springs for Bad Road Conditions					
190 c	**110 321 10 04**	Stabilus T 35×210[1]) 111 323 07 00 Bilstein Type B 36-001 111 323 13 00[2]) **111 323 17 00[3])**	**110 324 12 04**	**110 329 05 01**	Stabilus T 50×205/19 110 326 02 00[1]) Bilstein Type B 46-011 001 326 05 00[2])[4]) **111 326 01 00[3])**
190 Dc 220 b 220 Sb 220 SEb Sedan	111 321 17 04[1]) 111 321 19 04[2]) **110 321 09 04[3])**				
220 SEb/C	111 321 17 04[1]) **111 321 19/04[2])**				
Special Version: Harder Springs for Police Radio Cars and Special Purposes (for Ordinary Road Conditions)[6])					
190 c	**110 321 10 04**	Bilstein Type B 36-001 111 323 11 00[1]) 111 323 13 00[2]) **111 323 17 00[3])**	**110 324 12 04**	**110 329 05 01**	Bilstein Type B 46-011 001 326 01 00[1]) 001 326 05 00[2])[4]) **111 326 01 00[3])**
190 Dc 220 b 220 Sb 220 SEb Sedan	111 321 17 04[1]) 111 321 19 04[2]) **110 321 09 04[3])**				
Springs for Station Wagons					
190 c	**110 321 10 04**	standard	**110 324 28 04***	**110 329 06 01**	Bilstein Type B 46-011 110 326 10 00[1]) **110 326 12 00[2])**
190 Dc	**110 321 09 04**				
Springs for Ambulances					
190 c	**110 321 10 04**	standard	**110 324 21 04**	**110 329 05 01**	Bilstein Type B 46-011 110 326 10 00[1]) **110 326 12 00[2])***
190 Dc	**110 321 09 04**				

Note: Bold Type = Present Standard Version
When installing the springs, please check with the Tables "Springs, Corresponding Color Code".
Only the shock absorbers with a bold-face part number can be supplied as replacement parts.
For footnotes see page 32-0/4.

Footnotes to Table on Page 32-0/3.

[1]) 1st Version
[2]) 2nd Version
[3]) 3rd Version
[4]) Shock-absorbers should always be mounted with dust protectors.
[5]) The harder front spring Part No. 111 321 18 04 which is installed on Model 220 SEb/C as a standard part can be subsequently installed on Models 220 b, 220 Sb, and 220 SEb Sedan on request.
[6]) This combination can also be used for special purposes when the car is regularly driven with a very high trunk compartment load.
* [7]) In special cases, when the prescribed rear-wheel camber values cannot be obtained, the harder compensation spring Part No. 110 329 05 01 can be installed on Models 220 Sb and 220 SEb together with standard rear springs.

Cars with Air Suspension

Model	Front rubber diaphragm Designation Part No.	Associated front shock-absorber Designation Part No.	Rear rubber diaphragm Designation Part No.	Associated rear shock-absorber Designation Part No.
Standard Springs				
300 SE	Phoenix-Harburg Type 1 A 04 Z **112 320 00 17**	Bilstein Type B 36-006 112 323 04 00[1]) 112 323 07 00[2]) **112 323 08 00**[3])	Phoenix-Harburg Type 1 A 05 Z **112 320 00 21**	Bilstein Type B 46-011 000 326 89 00[1]) 112 326 00 00[2]) 112 326 01 00[3]) **112 326 02 00**[4])

[1]) 1st Version
[2]) 2nd Version
[3]) 3rd Version
[4]) 4th Version

B. Springs, Corresponding Color Code

a) Front Springs for Cars with 1st Version Front Axle Support, Corresponding Color Code

Associated front springs with faced upper coil end (Fig. 32-0/1).

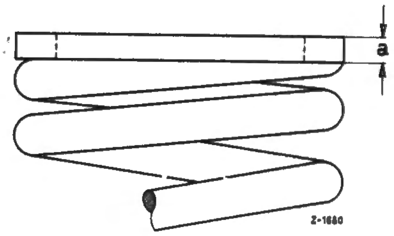


Fig. 32-0/1

a = Thickness of rubber washer

Standard Springs and Harder Springs for Bad Road Conditions

Models 220 b, 220 Sb, 220 SEb Sedan and Coupé

color code of front springs	Rubber washer — Car Version covering optional extras: sliding roof and automatic clutch					
	no optional extra		**one** optional extra		**two** optional extras	
	Part No.	Thickness "a" mm	Part No.	Thickness "a" mm	Part No.	Thickness "a" mm
white	111 322 02 84	8	111 322 03 84	10	111 322 04 84	12
red	111 322 01 84	5,5	111 322 02 84	8	111 322 03 84	10
blue	120 322 00 84	3	111 322 01 84	5,5	111 322 02 84	8

Note: By using the rubber washers between front axle support and spring which are specified in Table "Front springs, corresponding color code" the prescribed control arm position of the front axle will usually be obtained under test load.

In certain cases it may be necessary to use thicker rubber washers; it should be noted, however, that the total thickness of the rubber washers must not exceed 12 mm. Measurement procedure and adjustment values for the control arm position of the front axle are given in Job Nos. 40-0 and 40-3.

Special Version: Harder Springs for Police Radio Cars[1])

Models 220 b, 220 Sb, 220 SEb Sedan

Color code of front springs	Rubber washer — Car Version covering optional extras: sliding roof and automatic clutch					
	no optional extra		**one** optional extra		**two** optional extras	
	Part No.	Thickness "a" mm	Part No.	Thickness "a" mm	Part No.	Thickness "a" mm
white	120 322 00 84	3	111 322 01 84	5,5	111 322 02 84	8
red	Springs must not be used		120 322 00 84	3	111 322 01 84	5,5
blue	Springs must not be used		Springs must not be used		120 322 00 84	3

[1]) The harder springs for police radio cars can also be used for special purposes when the car is regularly driven with a very high trunk compartment load.

For the subsequent installation of front springs Part No. 111 321 12 04 in Models 220 Sb and 220 SEb Sedan the same color code table applies as for harder springs for police radio cars. As a result the control arm position prescribed for **normal road conditions** under test load will be achieved (see Job No. 40-0).

b) Front Springs for Cars* with 2nd Version Front Axle Support, Corresponding Color Code

Associated front springs with non-faced upper coil end (Fig. 32-0/2).

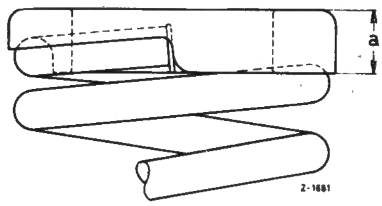


Fig. 32-0/2

a = Thickness of rubber mounting

Survey of Associated Tables

Model	Car Version (covering optional equipment such as sliding roof, automatic clutch or automatic transmission, power steering)			
	no optional extra	**one** optional extra	**two** optional extras	**three** optional extras
Standard Springs				
190 c	I	II	—	—
190 Dc	VII	I	—	—
220 b	I	II	III	IV
220 Sb	II	III	IV	V
220 SEb Sedan	III	IV	V	VI
220 SEb Coupé	I	II	III	IV
220 SEb Convertible	IV	V	VI	—
230 SL	III	IV	V	—
Special Version: Harder Springs for Bad Road Conditions				
190 c	I	II	—	—
190 Dc	I	I	—	—
220 b	II	II	III	IV
220 Sb	III	III	IV	V
220 SEb Sedan	IV	IV	V	VI
220 SEb Coupé	I	II	III	IV
220 SEb Convertible	IV	V	VI	—
Special Version: Harder Springs for Police Radio Cars (for Normal Road Conditions)[1]				
190 c	I	I	—	—
190 Dc	VII	VII	—	—
220 b	I	I	—	—
220 Sb	II	II	—	—
220 SEb Sedan	III	III	—	—
Springs for Station Wagons and Ambulances				
190 c, 190 Dc	I	—	—	—

Note: With the specified color code the control arm position prescribed for **normal road conditions** or for **bad road conditions** will be achieved under test load (see Job. No. 40-0).

For the subsequent installation of front springs Part No. 111 321 18 04 in Models 220 Sb and 220 SEb Sedan the same color code table applies as for harder springs for police radio cars. As a result the control arm position prescribed for **normal road conditions** under test load will be achieved.

[1]) The harder springs for police radio cars can also be used for special purposes when the car is regularly driven with a very high trunk compartment load.

Table	Color code for front springs	Rubber mounting Part No.	Thickness "a" mm
I	white	111 322 05 85	25
	red	111 322 04 85	22,5
	blue	111 322 03 85	20
II	white	111 322 06 85	27,5
	red	111 322 05 85	25
	blue	111 322 04 85	22,5
III	white	111 322 07 85	30
	red	111 322 06 85	27,5
	blue	111 322 05 85	25
IV	white	111 322 08 85	32,5
	red	111 322 07 85	30
	blue	111 322 06 85	27,5
V	white	Springs must not be used	
	red	111 322 08 85	32,5
	blue	111 322 07 85	30
VI	white	Springs must not be used	
	red		
	blue	111 322 08 85	32,5
VII	white	111 322 04 85	22,5
	red	111 322 03 85	20
	blue	Springs must not be used	

c) Rear Springs, Corresponding Color Code

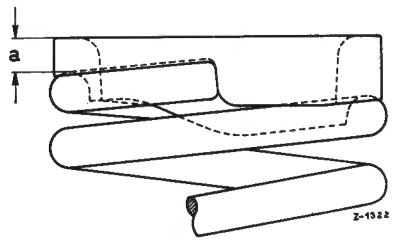


Fig. 32-0/3

a = Thickness of rubber mounting

Standard Springs, Harder Springs for Bad Road Conditions, Springs for Station Wagons and Ambulances

Models 190 c, 190 Dc, 220 b with 52-liter Fuel Tank

Color code of rear springs		Notch position of spring plate	Upper rubber mounting Part. No.	Thickness "a" mm
white	1 line	3	110 325 02 85	20
	2 lines	1		
	3 lines	2	110 325 03 85	14
red	1 line	3		
	2 lines	1		
	3 lines	2	110 325 04 85*	8
blue	1 line	3		
	2 lines	Springs must not be used		
	3 lines			

Models 220 b with 65-liter Fuel Tank, 220 Sb, 220 SEb Sedan and Coupé, 230 SL
Models 190 c, 190 Dc Station Wagons and Ambulances

Color code of rear springs		Notch position of spring plate	Upper rubber mounting Part. No.	Thickness "a" mm
white	1 line	1		
	2 lines	2	110 325 02 85	20
	3 lines	3		
red	1 line	1		
	2 lines	2	110 325 03 85	14
	3 lines	3		
blue	1 line	1		
	2 lines	2	110 325 04 85*	8
	3 lines	3		

Model 220 SEb Convertible*

Color code of rear springs		Notch position of spring plate	Upper rubber mounting Part. No.	Thickness "a" mm
white	1 line	Springs must not be used		
	2 lines			
	3 lines			
red	1 line			
	2 lines			
	3 lines			
blue	1 line	1	110 325 02 85	20
	2 lines	2		
	3 lines	3		

Note: With the specified color code the rear wheel camber prescribed for **normal road conditions** or for **bad road conditions** will be achieved under test load (see Job No. 40-0).

Special Version: Harder Springs for Police Radio Cars[1])

Models 190 c, 190 Dc

Color code of rear springs		Notch position of spring plate	Upper rubber mounting Part. No.	Thickness "a" mm
white	1 line	1	110 325 02 85	20
	2 lines	2		
	3 lines	3		
red	1 line	1	110 325 03 85	14
	2 lines	2		
	3 lines	3		
blue	1 line	1	110 325 04 85*	8
	2 lines	2		
	3 lines	3		

Models 220 b, 220 Sb, 220 SEb

Color code of rear springs		Notch position of spring plate	Upper rubber mounting Part. No.	Thickness "a" mm
white	1 line	Springs must not be used		
	2 lines			
	3 lines			
red	1 line	1	110 325 02 85	20
	2 lines	2		
	3 lines	3		
blue	1 line	1	110 325 03 85	14
	2 lines	2		
	3 lines	3		

[1]) The harder springs for police radio cars are the same as those used for bad road conditions. In these cars the trunk compartment is assumed to be under a constant load of approx. 100 kg. With the specified color code the rear wheel camber prescribed for **normal road conditions** will be achieved under test load (see Job No. 40-0). The harder springs for police radio cars can also be used for special purposes when the car is regularly driven with a very high trunk compartment load.

d) Compensating Springs at Rear Axle[1], Corresponding Color Code

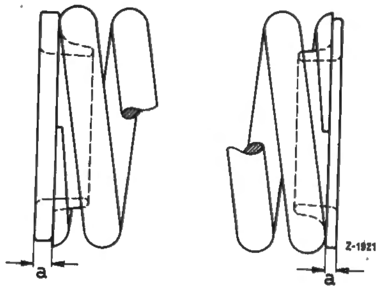


Fig. 32-0/4

a = Thickness of rubber ring

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL

Color code of compensating spring	Rubber ring			
	left		right	
	Part No.	Thickness "a" mm	Part No.	Thickness "a" mm
white	110 329 01 85	6	110 329 01 85	6
red	110 329 01 85	6	110 329 00 85	3
blue	110 329 00 85	3	110 329 00 85	3

[1]) In special cases the rear wheel camber can be increased on both sides by installing a compensating spring with blue color code together with two 6 mm high rubber rings.

C. Springs

Front Spring — Rear Spring — Compensating Spring

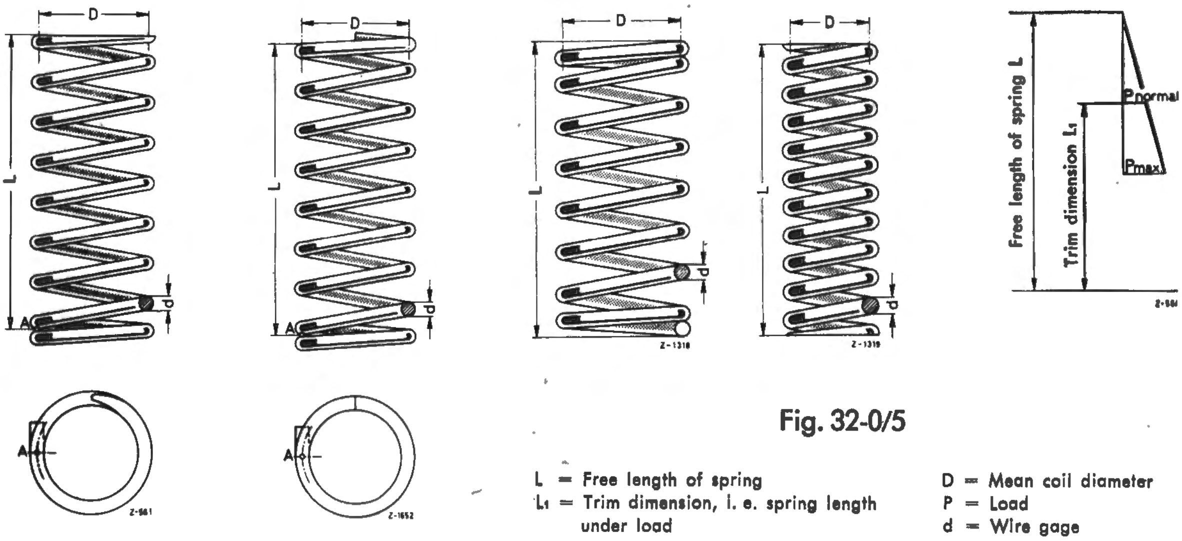


Fig. 32-0/5

L = Free length of spring
L1 = Trim dimension, i. e. spring length under load

D = Mean coil diameter
P = Load
d = Wire gage

Color Code for Front Springs

Front spring Part No.	Version	Color code		
		white	red	blue
		Trim dimension measured at P normal in mm		
111 321 08 04	1st	from 252.5 up to 255	above 255 up to 257.5	above 257.5 up to 260
	2nd	from 253 up to 255.5	above 255.5 up to 257.5	above 257.5 up to 260
111 321 09 04	1st	from 252.5 up to 255	above 255 up to 257.5	above 257.5 up to 260
	2nd, 3rd	from 253 up to 255.5	above 255.5 up to 257.5	above 257.5 up to 260
111 321 10 04	1st	from 258 up to 260.5	above 260.5 up to 262.5	above 262.5 up to 265
	2nd	from 260 up to 262.5	above 262.5 up to 264.5	above 264.5 up to 267
111 321 11 04	1st	from 250.5 up to 253	above 253 up to 255	above 255 up to 257.5
	2nd	from 253 up to 255,5	above 255.5 up to 257.5	above 257.5 up to 260
111 321 12 04 111 321 13 04		from 253 up to 255,5	above 255.5 up to 257.5	above 257.5 up to 260
111 321 16 04		from 246 up to 248.5	above 248.5 up to 250.5	above 250.5 up to 253
111 321 17 04 111 321 19 04* 110 321 09 04*		from 257 up to 259.5	above 259.5 up to 261.5	above 261.5 up to 264
111 321 15 04* 111 321 18 04* 110 321 08 04*		from 250 up to 252.5	above 252.5 up to 254.5	above 254.5 up to 257
110 321 10 04*		from 257 up to 259.5	above 259.5 up to 261.5	above 261.5 up to 264

Color Code for Rear Springs

Left and right rear spring Part No.		110 324 21 04	11 324 12 04	110 324 10 04 110 324 26 04	110 324 22 04 110 324 28 04	113 324 03 04 *
Color code		Trim dimension measured at P normal in mm				
white	1 line	from 212 up to 214	from 213 up to 215	from 206 up to 208	from 217 up to 219	from 190 up to 192
white	2 lines	above 214 up to 216	above 215 up to 217	above 208 up to 210	above 219 up to 221	above 192 up to 194
white	3 lines	above 216 up to 218	above 217 up to 219	above 210 up to 212	above 221 up to 223	above 194 up to 196
red	1 line	above 218 up to 220	above 219 up to 221	above 212 up to 214	above 223 up to 225	above 196 up to 198
red	2 lines	above 220 up to 222	above 221 up to 223	above 214 up to 216	above 225 up to 227	above 198 up to 200
red	3 lines	above 222 up to 224	above 223 up to 225	above 216 up to 218	above 227 up to 229	above 200 up to 202
blue	1 line	above 224 up to 226	above 225 up to 227	above 218 up to 220	above 229 up to 231	above 202 up to 204
blue	2 lines	above 226 up to 228	above 227 up to 229	above 220 up to 222	above 231 up to 233	above 204 up to 206
blue	3 lines	above 228 up to 230	above 229 up to 231	above 222 up to 224	above 233 up to 235	above 206 up to 208

Lower Rubber Mounting for Rear Springs

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL

Part No.	Height at spring seat mm
110 325 01 85	4

Color Code of Compensating Springs

Compensating spring Part No.	Color code		
	white	red	blue
	Trim dimension measured at P normal in mm		
110 329 04 01 110 329 05 01	from 220 up to 222	above 222 up to 224	above 224 up to 226
110 329 06 01	from 221 up to 223	above 223 up to 225	above 225 up to 227
113 329 03 01 *	from 222 up to 224	above 224 up to 226	above 226 up to 228

Checking Oil Reserve in Shock-Absorbers

Part No.	Designation	Shown in Fig.	Color Code	Piston rod extrusion "a" (see Figs. 32-0/6 and 32-0/7) Value for new shock-absorber mm	Maximum value mm
Front Shock-Absorbers					
111 323 04 00	Bilstein Type B 36-001	a	1 horizontal line green	30±2	61
111 323 08 00	Bilstein Type B 36-001	a	1 horizontal line green	30±2	61
111 323 09 00	Bilstein Type B 36-001	b	1 horizontal line green	30±2	61
111 323 10 00	Bilstein Type B 36-001	b	3 horizontal lines green	30±2	61
110 323 04 00	Bilstein Type B 36-001	c	1 horizontal line red	32.5±2	63
111 323 11 00	Bilstein Type B 36-001	c	1 horizontal line green	32.5±2	63
111 323 13 00	Bilstein Type B 36-001	c	2 horizontal lines green	32.5±2	63
110 323 07 00	Bilstein Type B 36-001	c	1 horizontal line red	5±2	35
111 323 17 00	Bilstein Type B 36-001	c	2 horizontal lines green	5±2	35
113 323 00 00*	Bilstein Type B 36-001	c	4 horizontal lines green	5±2	35
112 323 04 00	Bilstein Type B 36-006	d	1 horizontal line blue	29.5±2	60
112 323 07 00	Bilstein Type B 36-006	d	1 horizontal line blue	6±2	35
112 323 08 00	Bilstein Type B 36-006	d	1 horizontal line blue*	6±2	35
Rear Shock-Absorbers					
000 326 82 00	Bilstein Type B 46-011	a	1 horizontal line green	22±2	53
111 326 00 00	Bilstein Type B 46-011	a	3 horizontal lines green	22±2	53
001 326 00 00	Bilstein Type B 46-011	b	1 horizontal line red	17.5±2	48
001 326 01 00	Bilstein Type B 46-011	b	1 horizontal line green	17.5±2	48
001 326 05 00	Bilstein Type B 46-011	b	2 horizontal lines green	17.5±2	48
110 326 11 00	Bilstein Type B 46-011	b	1 horizontal line red	5±2	30
111 326 01 00	Bilstein Type B 46-011	b	2 horizontal lines green*	5±2	30
113 326 00 00 *	Bilstein Type B 46-011	b	4 horizontal lines green	5±2	30
110 326 10 00 / 110 326 12 00 *	Bilstein Type B 46-011	b	3 horizontal lines red	0+1	10
000 326 89 00	Bilstein Type B 46-011	b	1 horizontal line blue	17.5±2	48
112 326 00 00	Bilstein Type B 46-011	b	1 horizontal line blue	8±2	26
112 326 01 00	Bilstein Type B 46-011	b	2 horizontal lines blue	8±2	26
112 326 02 00	Bilstein Type B 46-011	b	1 horizontal line blue	8±2	26

Upper Shock-Absorber Suspension

Bilstein shock-absorber with M 9×1 thread on piston rod (previous version)

Models 220 b, 220 Sb, 220 SEb Sedan	Part No.	Height mm	External diameter mm	Rubber hardness ° Shore
Rubber mounting parts for Front shock-absorbers (see Figs. 32-0/8 and 9)				
Upper and lower rubber ring (3)	000 323 12 85	16±0.25	27	70±5
Upper rubber cup (4)	000 323 11 62	3	42	82±5
Protective rubber sleeve (5) 1)	111 323 01 38	7	48	75±5
Rubber mounting parts for rear shock-absorbers (see Fig. 32-0/10)				
Rubber ring upper (3)	180 326 01 68	19+0.5	40	57±5
Rubber ring lower (4)	180 323 04 85		35	40±5

Length of spacer tube of upper shock-absorber suspension

Front shock-absorber 2)	Rear shock-absorber
38 mm	36 mm

Initial stress for rubber rings
(limited by spacer tube)

Front shock-absorber	Rear shock-absorber
approx. 9 mm	approx. 7 mm

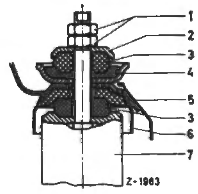


Fig. 32-0/8
With protective steel sleeve

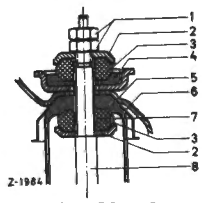


Fig. 32-0/9
With protective rubber sleeve

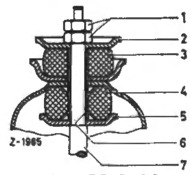


Fig. 32-0/10

1) On the 1st version with protective steel sleeve (7) a 7 mm high rubber cap was installed (Fig. 32-0/8).
2) On the 1st version, the spacer tube was firmly connected with the protective steel sleeve (7) (Fig. 32-0/8).

Bilstein shock-absorber with M 10×1 thread on piston rod (present version)

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL		Part No.	Height mm	External diameter mm	Rubber hardness ° Shore
Rubber mounting parts for front shock-absorber (see Fig. 32-0/11).					
Upper rubber ring (3)		180 326 01 68	19+0.5	40	57±5
Lower rubber ring (5)		000 323 12 85	16±0.25	27	70±3
Protective rubber sleeve (4)		111 323 01 38	7	46	80±5
Rubber mounting parts for rear shock-absorber (see Figs. 32-0/12 and 13)					
Upper rubber ring (3)		180 326 01 68	19+0.5	40	57±5
Lower rubber ring (4)	1st version	180 323 04 85		35	40±5
	2st version	110 323 05 85 1) 2)			64±5

Initial stress for rubber rings

Front shock-absorber	Rear shock-absorber
approx. 9 mm	approx. 7 mm

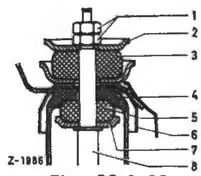


Fig. 32-0/11

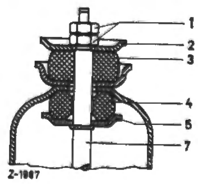


Fig. 32-0/12
For normal roads

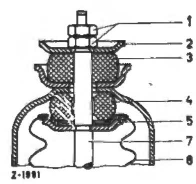


Fig. 32-0/13
For bad roads 3)

1) During a transitional period No. 180 323 04 85 is stamped in these rings with 64° Shore hardness. To distinguish them from the rubber rings with 40° Shore hardness they are marked in red.
* 2) **When replacing shock absorbers use only rubber rings of 64° Shore hardness!**
* 3) **With Bilstein shock absorbers Part No. 001 326 05 00 always install dust protector (8) even for normal road conditions!**

Stabilus shock-absorber with M 10×1 thread for bad road conditions (previous version)

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb		Part No.	Height mm	External diameter mm	Rubber hardness ° Shore
Rubber suspension parts for front and rear shock-absorbers[1]) Figs. 32-0/14 and 15)					
Rubber ring	upper (3)	180 326 01 68	19+0.5	40	57±5
	lower (4)	180 323 04 85		35	40±5
Initial stress for rubber rings					
Front and rear shock-absorbers		approx. 5 mm			

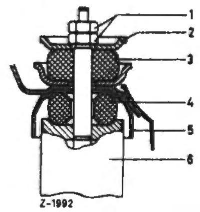


Fig. 32-0/14

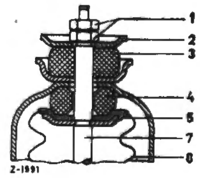


Fig. 32-0/15

* [1]) **Always mount rear shock absorber with dust protector (8)!**

Lower shock-absorber suspension

Model	Rubber mounting: Part No.	Length (pressed in) mm	Internal diameter	External diameter	Rubber hardness ° Shore	Version	Shock absorber eye internal diameter mm	Remarks
Front shock-absorber (Figs. 32-0/16 and 17)								
190 c 190 Dc 220 b 220 Sb 220 SEb 230 SL	—	34	15	30	65±5	1st version	30+0.2	Rubber mounting connot be replaced in case of repairs
					75±5	2nd version		
300 SE	—	32.5		26	65±5	1st version	26+0.2	
					75±5	2nd version		
Rear shock-absorber								
190 c 190 Dc 220 b 220 Sb 220 SEb 230 SL 300 SE	110 326 01 81	42	16	30[1])	65±5	1st version	30.000 30.130	Rubber mounting can be re-placed in case of repairs
	110 326 02 81				75±5	2nd version		

Free bolt length "a" of pivot pin (13) on rear axle tube	46—0.5 mm
Installed length "b" of rubber mounting (11)	40—0.5 mm (Deviations from the free bolt length "a" or the installed length "b" can be compensated by adding a shim (16 mm I. D. and appr. 23 mm O. D.) between the rear washer (8) and the cup (9).
Depth of cup (9) for fastening the shock-absorber	3.0 mm

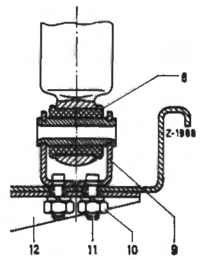


Fig. 32-0/16
With steel springs

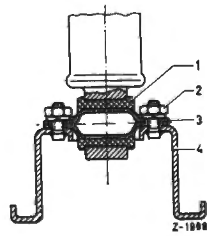


Fig. 32-0/17
With air springs

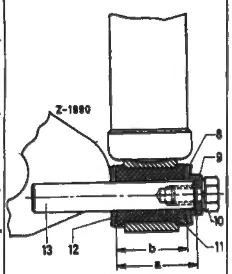


Fig. 32-0/18

[1]) The rubber mounting must be firmly seated in the shock-absorber eye.

E. Torsion Bar

Torsion Bar Fastening on Lower Control Arm

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL

Rubber buffer Part No.	Rubber buffer Height mm	Rubber hardness ° Shore
111 323 00 44	28	50±5
Hexagon srew length		200 mm
Spacer tube length		68 mm
Distance "a" from screw end to upper edge of hexagon screw nut (see Figs. 32-6/2 and 32-6/5)		23±1 mm

F. Additional Rubber Buffers

Rubber Buffers on Front Axle

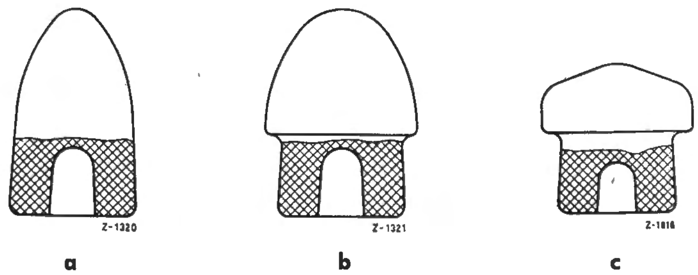
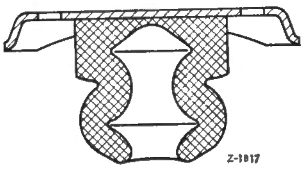


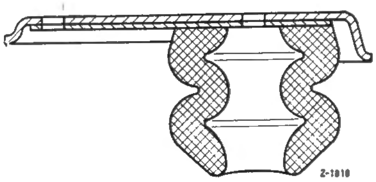
Fig. 32-0/19

Model	Rubber buffer Part No.	Rubber buffer Rubber hardness ° Shore	Height mm	Shown in Figure	Remark
190 c, 190 Dc, 220 b, 220 Sb, 220 SEb 230 SL	111 333 02 65	65±5	76	a	For normal road conditions
	111 333 07 65	70±5	79	b	For bad road conditions
300 SE	112 333 02 65	65±5	59	c	

Rubber Buffers on Rear Axle

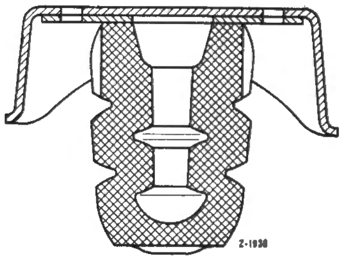


a



b

Fig. 32-0/20



c

Model	Rubber buffer		Shown in Figure
	Part No.	Rubber hardness ° Shore	
190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL	110 320 05 44[1])		a
300 SE	112 320 09 44[2])	45±3	b
190 c, 190 Dc Station wagons and ambulances	110 320 06 44[3])		c

[1]) Rubber buffer firmly connected with cup
[2]) Associated stop plate Part No. 112 325 04 43
[3]) Associated cup Part No. 110 325 01 42

G. Torque Reading

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL, 300 SE

Rear lower shock-absorber suspension	hexagon nut (1st version)	appr. 4 mkg
	hexagon screw (2nd version)	appr. 5 mkg
Hexagon screws for fastening the right support for the compensating spring to the axle tube of the rear axle		appr. 13 mkg

Air Chambers with Bellows

Model 300 SE

	Front axle	Rear axle
Air capacity	2.8 l	3.6 l
Working pressure according to car load	6.0 to 7.5 atm	5.5 to 8.0 atm
Test pressure for leak test with air under water	3.5 atm	

Leak Test of Air Suspension System

Model 300 SE

Permissible decline of working pressure with the vehicle in "rest" position	1 atm within 24 hours

Air Reservoir

Model 300 SE

Capacity	approx. 7 l
Working pressure according to height above sea level[1])	12—18 atm
Test pressure for leak test with air under water	approx. 8 atm
Non-return valve *	Bosch LF/VB 2 A 1
Drain valve *	Bosch LF/VE 1 A 1

[1]) If the working pressure drops below 9 atm, the white warning lamp lights up in the instrument cluster.

Valve Unit

Model 300 SE

Designation		Bosch LF/EVA 1/1 (1st version) Bosch LF/EVA 1 A 1 2nd version)
Pressure distribution to leveling valves	Front axle	limited by reducing valve
	Rear axle	full working pressure
Adjustment of reducing valve (for compressed air to front axle)		approx. 10.0 atm
Adjustment of pressure valve (for exhaust air from front axle)		approx. 3.0 atm
Adjustment of safety valve	Escaping pressure	approx. 23 atm
Adjustment of electrical pressure indicator for warning lamp		9.0±1 atm

Leveling Valves

Model 300 SE

	Front axle	Rear Axle
Designation	left LF/VNB 3 A2 (1st version LF/VNB 3 B 2 (2nd version)[1]) right LF/VNB 1 A 1 (1st version LF/VNB 1 B 1 (2nd version)[1])	LF/VNB 2 A 1 (1st version) LF/VNB 2 B 1 (2nd version)[1])
Throttle section for inlet and outlet valve	1.63/1.5 mm ⌀	1.73/1.5 mm ⌀
Lever length	110 mm	
Basic length of connecting rods for leveling valves[2])	approx. 193 mm	approx. 143.5 mm[3])

*[1]) Version with vulcanised valve inserts
[2]) From center to center ball joint.
[3]) 2nd version arrangement of leveling valve (round hole in bracket on chassis base panel). On the 1st version arrangement of the leveling valve (two beads on bracket on chassis base panel) the connecting rod is approx. 156 mm long.

Tightening Torques

Model 300 SE

Cap screws of air lines and hoses	approx. 1.5 mkg
Phillips head countersunk screws for fastening bellows to air chambers	approx. 2 mkg
Non-return valve on air reservoir	approx. 3 mkg

Removal and Installation of Front Shock-Absorber

Job No. 32-2

Modification: Shock-Absorber Suspension added as shown in Figs. 32-2/6 and 32-2/9

Note: In the case of cars with air suspension see "General Instructions for Assembly Work"! (See Job No. 32-11)

Removal:

1. Jack up the car at the front and remove the front wheel.

2. Detach the lower shock-absorber suspension. To do this, unscrew the two hexagon nuts from the lower control arm (Fig. 32-2/1).

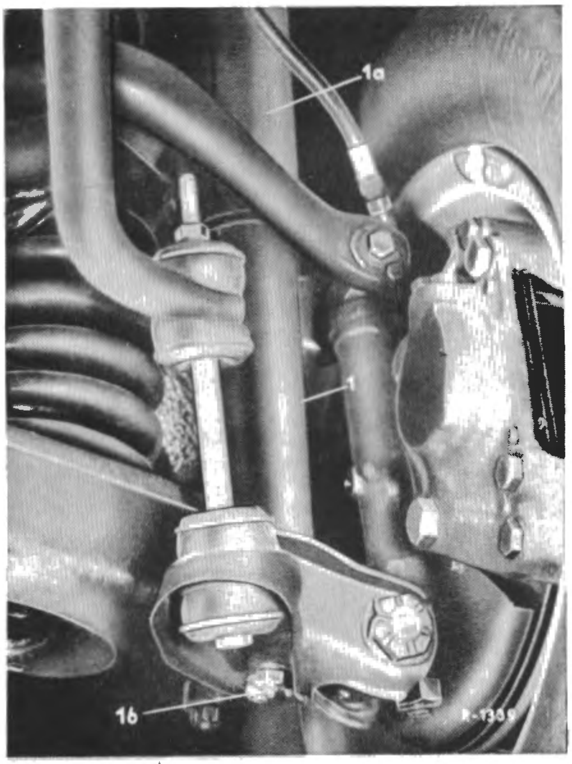


Fig. 32-2/1

1 Shock-absorber
1a Protective rubber sleeve
1b Lower shock-absorber suspension

Note: On cars with air suspension the hexagon nuts of the lower shock-absorber suspension are located within the lower control arm (Fig. 32-2/9).

3. Detach the upper shock-absorber suspension (1) and remove the components (Fig. 32-2/2).

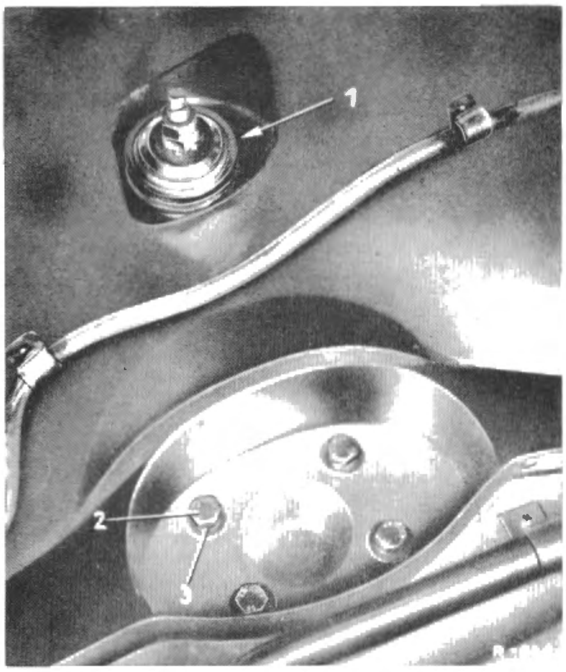


Fig. 32-2/2

1 Upper shock-absorber suspension
2 Hexagon screws and lock washers for fastenig the rubber mounting for the front axle support
3 Washer

Note: a) The individual components of the shock-absorber suspension differ according to the various shock-absorber models (Figs. 32-2/4 to 9).

b) On the first cars the upper shock-absorber suspension can only be detached after removing the battery on the left and the air intake silencer on the right. On recent cars, however, the wheel arch is recessed so that these procedures are no longer necessary.

4. Compress the shock-absorber and install the tensioning fixture 111 589 03 61 (3). Then remove the shock-absorber and take off the tensioning fixture. Pull off the protective sleeve (2) and the upper suspension parts from the piston rod (Fig. 32-2/3).

Note: The tensioning fixture is not required for removing and installing Stabilus shock-absorbers for bad road conditions.

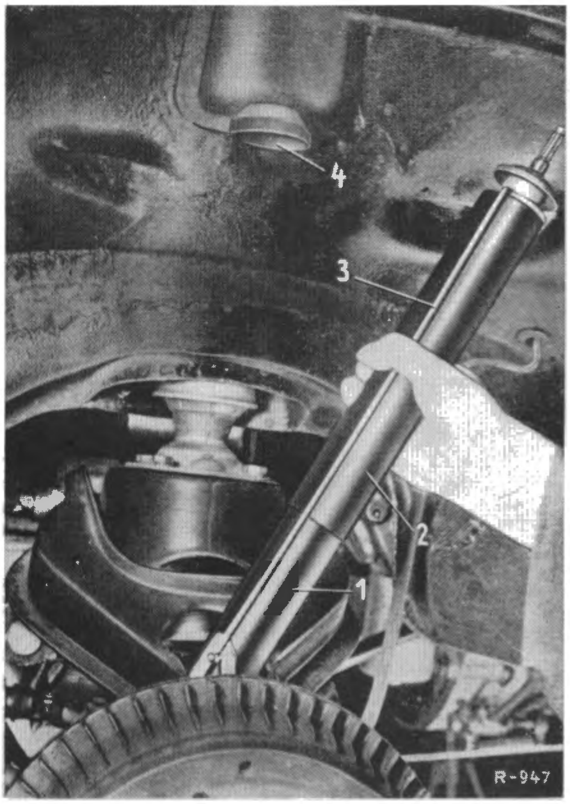


Fig. 32-2/3

1 Front shock-absorber
2 Protective sleeve
3 Tensioning Fixture 111 589 03 61

Installation:

5. Before re-installing, check the rubber bearing and the fixing plate of the lower suspension (Figs. 32-2/8 and 9).

6. Check the upper suspension components and rub the rubber parts with talc (Figs. 32-2/4 to 7).

7. Install the shock-absorbers (Figs. 32-2/4 to 9). Before installing Bilstein and Stabilus gas pre-loaded shock-absorbers compress them by means of Tensioning Fixture 111 589 03 61 (3) (Fig. 32-2/3).

The following details require attention:

Upper Shock-Absorber Suspension

Screw the lower hexagon nut in completely, tighten it and lock it with the upper hexagon nut (Figs. 32-2/4 to 7).

Bilstein shock-absorbers with M 9 × 1 thread on piston rod:

Metal protective sleeves (7) are used in the 1st version upper suspension and protective rubber sleeves (5) in the 2nd version. If the metal sleeve rubs against the shock-absorber housing the rubber sleeve should be installed subsequently.

Use the right spacer tube for the rubber sleeve version (see Table in Job No. 32-0). The dish of the two cups (2) should point toward the rubber ring (Figs. 32-2/4 and 5).

Bilstein and Stabilus shock-absorbers with M 10 × 1 thread on piston rod:

The dish of the rubber cup should point upward. Push on the upper rubber ring with the rounded side pointing downward (Figs. 32-2/6 and 7).

Stabilus shock-absorbers for bad road conditions:

Push on the lower rubber ring (4) with the rounded side pointing upward and the lower rubber ring (3) with the rounded side pointing downward (Fig. 32-2/7). The dish of the upper cup should point upward.

Upper Shock-Absorber Suspension

Bilstein Shock-Absorber
Piston rod with thread M 9 × 1

1st version

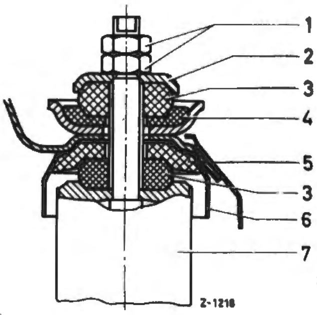


Fig. 32-2/4

1 Hexagon nuts
2 Upper cup
3 Upper and lower rubber ring
4 Upper rupper cup
5 Lower rubber cup
6 Protective cap at chassis base panel
7 Protective metal sleeve and spacer tube

2nd version

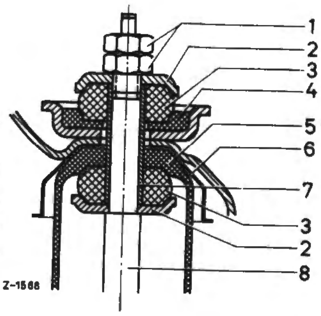


Fig. 32-2/5

1 Hexagon nuts
2 Cup
3 Upper and lower rubber ring
4 Upper rubber cup
5 Protective rubber sleeve
6 Protective cap at chassis base panel
7 Spacer tube (length 38 mm)
8 Piston rod

Bilstein and Stabilus Shock-Absorber

Piston rod with thread M 10 × 1

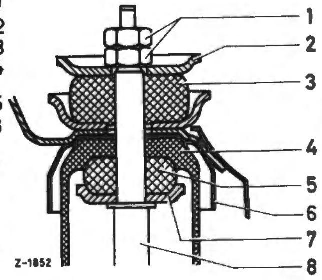


Fig. 32-2/6

1 Hexagon nuts
2 Upper cup
3 Upper rubber ring
4 Protective rubber sleeve
5 Lower rubber ring
6 Protective cap at chassis base panel
7 Lower cup (pressed onto piston rod)
8 Piston rod

Stabilus Shock-Absorber for Bad Road Conditions
Piston rod with thread M 10 × 1

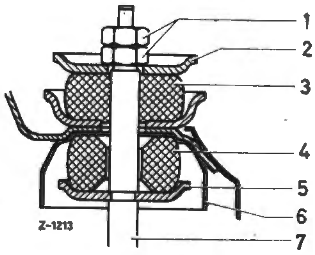


Fig. 32-2/7

1 Hexagon nuts
2 Upper cup
3 Upper rubber ring
4 Lower rubber ring
5 Lower cup (pressed onto piston rod)
6 Protective cap at chassis base panel
7 Piston rod

Lower Shock-Absorber Suspension

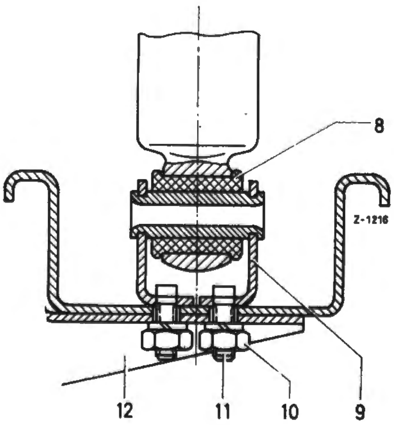


Fig. 32-2/8

Cars with steel spring suspension

8 Rubber mounting
9 Fixing plate
10 Hexagon nuts with lock washers
11 Threaded pin
12 Lower control arm

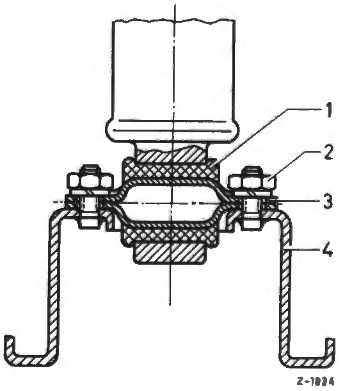


Fig. 32-2/9

Cars with air suspension

1 Rubber mounting
2 Hexagon nuts with lock washers
3 Fixing plate
4 Lower control arm

Job No. 32-3

Removal and Installation of Rear Shock-Absorber

Modification: Model 230 SL and Shock-Absorber alignment added on page 32-3/4

Note: In the case of cars with air suspension see "General Instructions for Assembly Work" (See Job No. 32-11).

Removal:

Note:

The rear shock-absorbers serve at the same time as spring stops for the rear wheels. It is necessary therefore when the car is jacked up, to support the appropriate axle tube before detaching the upper or lower shock-absorber suspension.

The jack can be placed either under the torque arm or, together with Flange 111 589 01 63, under the rear axle shaft (see Fig. 32-5/2).

When shock-absorbers are to be replaced it is advisable to put the rear wheels of the car over a pit.

1. Working from the trunk compartment, remove the upper shock-absorber suspension (1). Remove the hexagon nuts, the cup, and the upper rubber ring (Fig. 32-3/1).

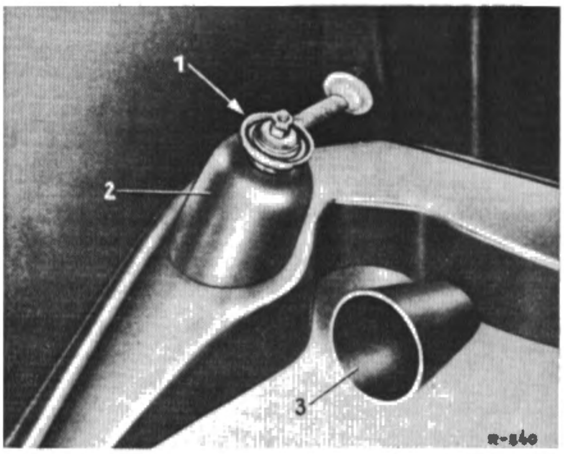


Fig. 32-3/1

1 Upper shock-absorber suspension
2 Dome on chassis base panel
3 Rubber protective cap

Note: On Model 230 SL the upper rear suspension is accessible from the top box when the roadster top is closed (Fig. 32-3/1a). On cars with a coupé top, the top must be removed.

2. Detach the lower shock-absorber suspension (8). Remove the hexagon nut or hexagon screw together with lock washer, cup, and washer. Press the shock-absorber off the bolt and remove downward (Figs. 32-3/2, 6, and 7).

3. Remove the upper suspension components from the piston rod (Fig. 32-3/3 to 5).

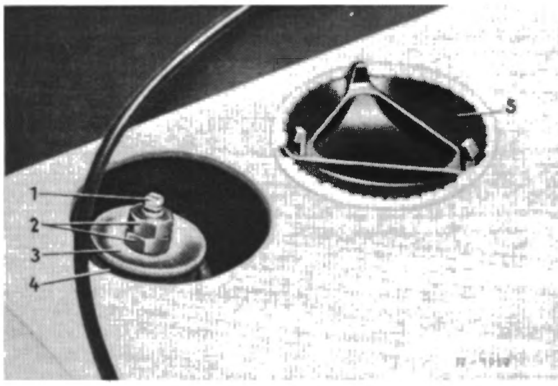


Fig. 32-3/1a

1 Piston rod
2 Hexagon screws
3 Upper cup
4 Upper rubber ring
5 Cover

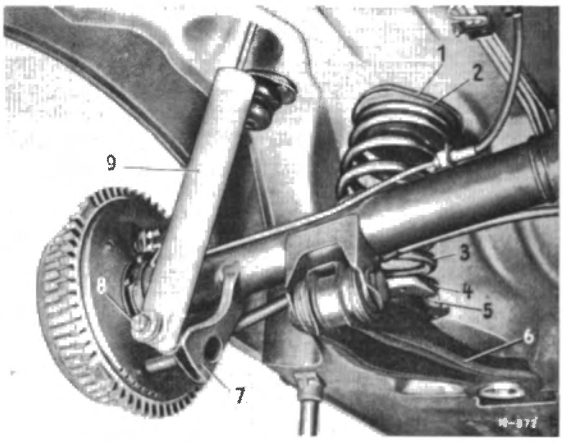


Fig. 32-3/2

1 Upper spring plate on chassis base panel
2 Upper rubber mounting
3 Rear spring
4 Lower rubber mounting
5 Lower spring plate
6 Torque arm
7 Support for lower shock-absorber suspension
8 Lower shock-absorber suspension
9 Rear shock-absorber

Note: The individual parts of the upper suspension differ in the various shock-absorber models (Figs. 32-3/3 to 5).

Installation:

4. Before reinstalling, check the rubber mounting (11) of the lower suspension (Fig. 32-3/7).

Replace any rubber mounting showing signs of external or internal wear. The rubber mounting must be firmly seated in the shock-absorber eye. If the bore is larger than 30.2 mm dia. the shock-absorber must be replaced in any case, since there is no longer any guarantee that the rubber mounting will be firmly seated.

5. Check the spacer tube (6) on the 1st version of the upper suspension. If chafed spots are found on the side of the spacer tube, this is an indication that during normal running the spacer tube has fouled the dome on the chassis base panel (Fig. 32-3/3).

   The through-bore in the shock-absorber dome has been enlarged from $15.5^{+0.5}$ mm dia. to $16.5^{+0.5}$ mm dia. If repairs are carried out on older models, the bore should be enlarged to 16.5 mm dia.
   To do this, use an angular hand grinder or, if this is not available, a high-speed hand drill and a 15 mm dia. grinding cylinder to increase, the bore, working from the trunk compartment.

6. Check the rubber rings of the upper suspension and rub them with talc.

7. Fit the shock-absorbers (Figs. 32-3 and 4).

   Please note carefully the following points:

Lower Shock-Absorber Suspension

Check distance "a" of the pivot pin. It should be $46_{-0.5}$ mm. If the distance is larger, a corresponding shim with an internal diameter of 16 mm and an external diameter of 23 mm should be added between the washer (8) and the cup (9). This is necessary in order to ensure that the rubber mounting has the prescribed installed length "b" of $40_{-0.5}$ mm. It is not permissible to use a standard washer instead of the cup (9), since in that case the rubber mounting would no longer have the specified initial stress (Fig. 32-3/4).

When tightening the hexagon nut or the hexagon screw of the lower shock-absorber suspension pay attention to the specified tightening torque (see Job No. 32-0).

Fig. 32-3/6 shows the 1st version of the lower shock-absorber suspension and Fig. 32-3/7 shows the 2nd version which is also the repair version. For fastening the shock-absorber the 1st version pivot pin has a threaded part, whereas the 2nd version is provided with an internal thread. If on the 1st version pivot pin the threaded part has broken as a result of excessive tightening of the hexagon nut, the pivot pin can be made to correspond to the 2nd version (Fig. 32-3/7).

Upper Shock-Absorber Suspension

Push on the lower rubber ring (4) with the rounded side pointing upward and the upper rubber ring (3) with the rounded side pointing downward. Make sure that the correct cups and for the piston rod with an M 9 × 1 thread the correct spacer tube (length 36 mm) are fitted (Fig. 32-3/3). Shock absorbers with a piston rod thread M 10×1 have no spacer tube. The dish of the upper cup must point upward.
For piston rod threads M 10×1 use only 8 mm high hexagon nuts.
In order to obtain the correct initial stress of the rubber rings, the lower hexagon nut should be screwed on up to the end of the thread, while the piston rod is being held steady at the top with a wrench.

In the case of the piston rod with an M 9×1 thread the upper cup (2) must lie firmly against the spacer tube (6) in order to prevent rattling noises.

Screw on the upper hexagon nut and lock by means of the lower hexagon nut (Fig. 32-3/3).

Shock-absorbers
for bad road conditions:

Shock-absorbers for bad road conditions are provided with a dust protector (8) in order to prevent damage by dust to the piston rod and its seals (Fig. 32-3/5). When installing the shock-absorber push the dust protector over the piston rod and attach it to the base of the shock-absorber housing by means of a hose clip (50 mm ∅). Care should be used to ensure that, when the shock-absorber is fully extended, the dust protector is not stretched to its full extent, but remains rather slack.

Upper Shock-Absorber Suspension

Bilstein Shock-Absorber

Bilstein Shock-Absorber
Piston rod with thread M 9 × 1
(previous version)

Bilstein and Stabilus Shock-Absorber
Piston rod with thread M 10 × 1
(present version)

Bilstein Shock-Absorber and Stabilus Shock-Absorber for Bad Road Conditions (with dust protector)[1]
Piston rod with thread 10 × 1

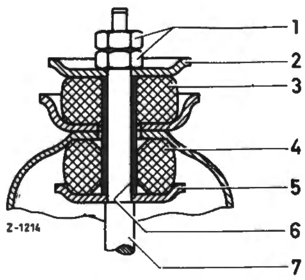


Fig. 32-3/3

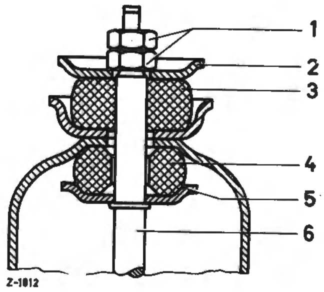


Fig. 32-3/4

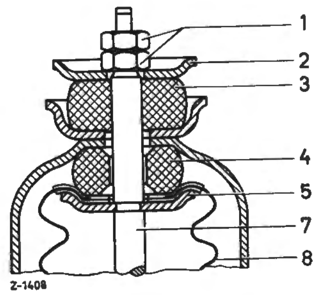


Fig. 32-3/5

1 Hexagon nuts (on M 10×1 threads use 8 mm high nuts)
2 Upper cup
3 Upper rubber ring
4 Lower rubber ring
5 Lower cup on the piston rod
6 Spacer tube (length 36 mm)
7 Piston rod
8 Dust protector

* 1) On Bilstein Shock-Absorber Part No. 001 326 05 00 install dust protector (8) also for normal road conditions.

Lower Shock-Absorber Suspension

1st version

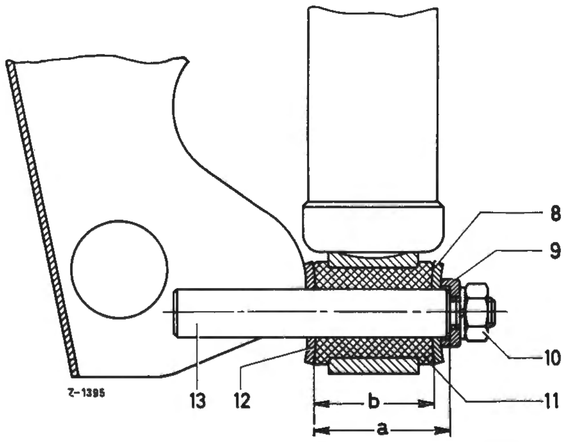


Fig. 32-3/6

2nd version and repair version

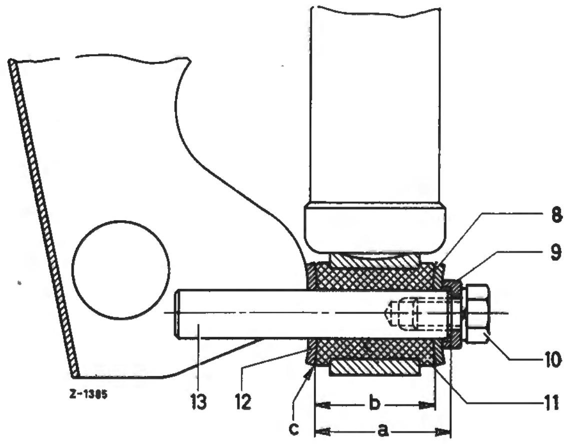


Fig. 32-3/7

a Distance of pivot pin from inner washer (free length of bolt)
8 Washer
9 Cup
10 Hexagon nut and lock washer (on 2nd version and repair version hexagon screw and lock washer)
b Installed length of rubber mounting
11 Rubber mounting
12 Washer on pivot pin
13 Pivot pin in the support on the axle tube

*** Shock-Absorber Alignment**

The service life of a shock-absorber depends to a large extent on the proper alignment of the two suspension points. In order to check the alignment (e. g. when repairs are carried out after an accident) remove the rear shock-absorbers and install the gage shown in Fig. 32-3/8. For this test the road wheels must be on the ground. The gage can be made in the shop in accordance with the measurements given below.

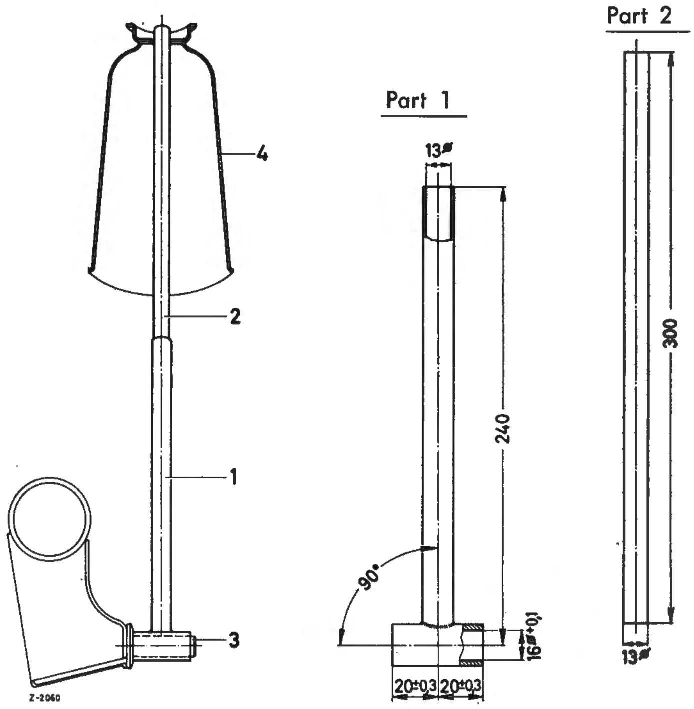


Fig. 32-3/8

1 Guide tube
2 Internal tube (sliding)
3 Pivot pin of the lower suspension in the rear wheel axle tube
4 Upper suspension dome on the chassis base panel

Job No.
32-3 a

Trouble-Shooting Hints for Shock-Absorber Noises

If there are noises proceeding from the rear axle, which are due to the shock-absorbers or their suspension, the following points should be given particular attention. As a general rule it can be assumed that the noises are due not to the shock-absorbers themselves but to their suspension.

a) Rumbling Noises (on Bilstein and Stabilus shock-absorbers)

Check the upper shock-absorber suspension (see Job No. 32-3); in particular:

Cups (inside diameter) and spacer tube (length).

Rubber rings and cups for correct assembly.

Check the tightening torque and locking device of the hexagon nuts.

Check the diameter of the through bore in the shock-absorber dome on the chassis base panel.

Check the lower shock-absorber suspension (see Job No. 32-3):

Check the distance "a" of the pivot pin in the axle tube in relation to the inner cup (Fig. 32-3/3c).

Check the installed length "b" of the rubber mounting (Fig. 32-3/3c).

Check the internal diameter and the length of the rubber mounting.

Check the correct position of the rubber mounting in the shock-absorber eye.

Check the cups (depth) and the washers for the shock-absorber mounting.

b) Knocking Noises (Bilstein shock-absorbers)

Check the oil reserve in the shock-absorber.

When oil loss is excessive, the shock-absorber shows a tendency to knock (see also Job No. 32-8).

c) Hissing Noises (Bilstein shock-absorbers)

Bilstein shock-absorbers tend to produce hissing noises if the compensator plunger has a leak, since in this case part of the gas beneath the compensating plunger may get into the oil system. It may well be that such shock-absorbers function properly, but under the circumstances they should be replaced nevertheless.

If in special cases, after the shock-absorbers have been replaced and the upper and lower suspension have been checked, rumbling noises should persist, these may be transmitted by the rear axle. In this case remove the rear axle and check the axle tube mounting, the suspension, and the sliding joint.

Removal and Installation of Front Spring

Job No.
32-4

Modification: Cars with 2nd version front axle support (Addition)

A. Cars with 1st Version Front-Axle Support

Removal:

1. Jack up the car at the front and remove the front wheel and on cars with drum brakes remove the brake drum.
2. Remove the front shock-absorber (see Job No. 32-2).
3. Detach the torsion bar at the lower control arm (see Job No. 32-6).
4. Unscrew the two outer of the hexagon screws (5) for attaching the pivot pin (6) for the lower control arm (19) to the front axle support (2) (Fig. 32-4/1).

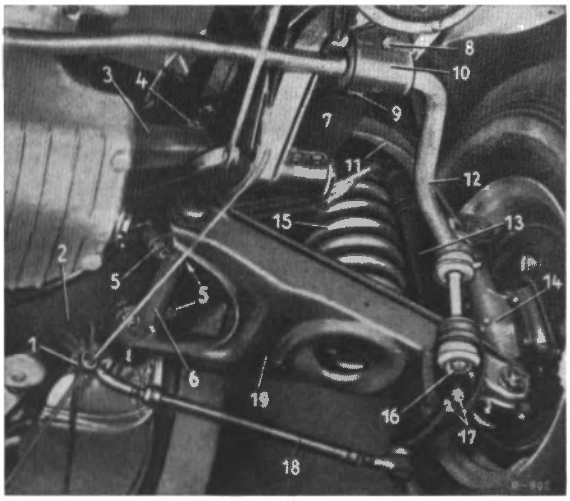


Fig. 32-4/1

1 Cable guide at front axle support
2 Front axle support
3 Engine support
4 Hexagon screw and spring washer
5 Hexagon screws with nuts and lock washers for fastening the pivot pin to the front axle support
6 Pivot pin for lower control arm
7 Flat spring supporting the front axle support
8 Hexagon screw (M 12×1.5×25) with lock washer
9 Hexagon screw (M 14×1.5×25 with lock washer
10 Rubber mounting for torsion bar
11 Upper control arm
12 Torsion bar
13 Front shock-absorber
14 Steering knuckle
15 Front spring
16 Hexagon screw for fastening the torsion bar to the lower control arm
17 Hexagon nuts with lock washers for fastening the lower shock-absorber suspension
18 Tie-rod
19 Lower control arm

5. Insert the two guide pins of Cradle 111 589 00 63 (3) in the eyes on the pivot pin (4) for the lower control arm. Then slide the jack under the car to fit the lower bolt of the cradle, and support the lower control arm (Fig. 32-4/2).
6. Unscrew the two inner of the four hexagon screws from the pivot pin (4). Now carefully lower the car jack and remove the front spring together with the rubber washer (Fig. 32-4/2).

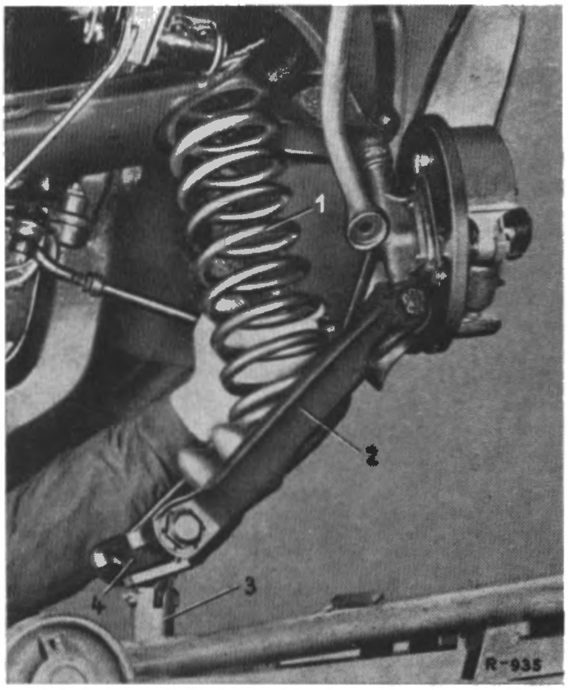


Fig. 32-4/2

1 Front spring
2 Lower control arm
3 Jack Cradle 111 589 00 63
4 Pivot pin for lower control arm

Installation:

7. Rub the rubber washer (7) for the front spring with talc. Insert the spring together with the rubber washer (Fig. 32-4/3). The faced end of te spring must point upward.

Note: On cars with a 1st version front axle support, springs with faced upper coil ends and smooth rubber washers are used, whereas cars with the 2nd version front axle support have springs with non-faced coil ends and the springs are centered by rubber mountings fitting the coil end (see Job No. 32-0).

Installation:

7. Rub the rubber washer for the front spring with talc and attach it to the spring with masking tape (Fig. 32-4/3). Insert the spring in the lower control arm.

Note: The various spring lengths and trim dimensions of the front springs are compensated by rubber washers of different thickness (see Job No. 32-0).

8. Use the jack with Cradle 111 589 00 63 (3) to press the lower control arm (4) upward after having correctly positioned the pivot pin by means of the two Guides 120 589 01 31 (5) (Fig. 32-4/4).

Care must be taken to ensure that the spring is properly seated in the lower control arm and the rubber washer in the front axle support.

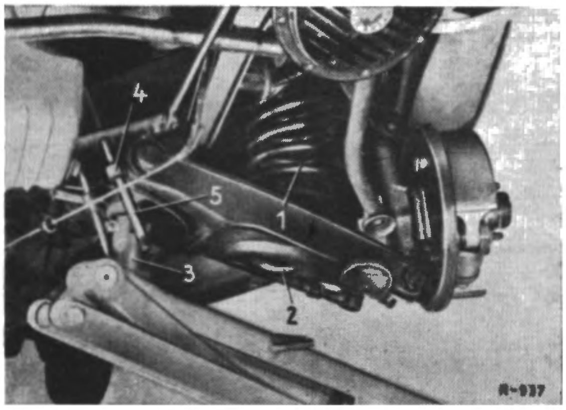


Fig. 32-4/4

1 Front spring
2 Lower control arm
3 Jack Cradle 111 589 00 63
4 Pivot pin for lower control arm
5 Guides 120 589 01 31

9. Now raise the lower control arm further, sliding the guide pins of Cradle 111 589 00 63 into the screw holes of the front axle support.

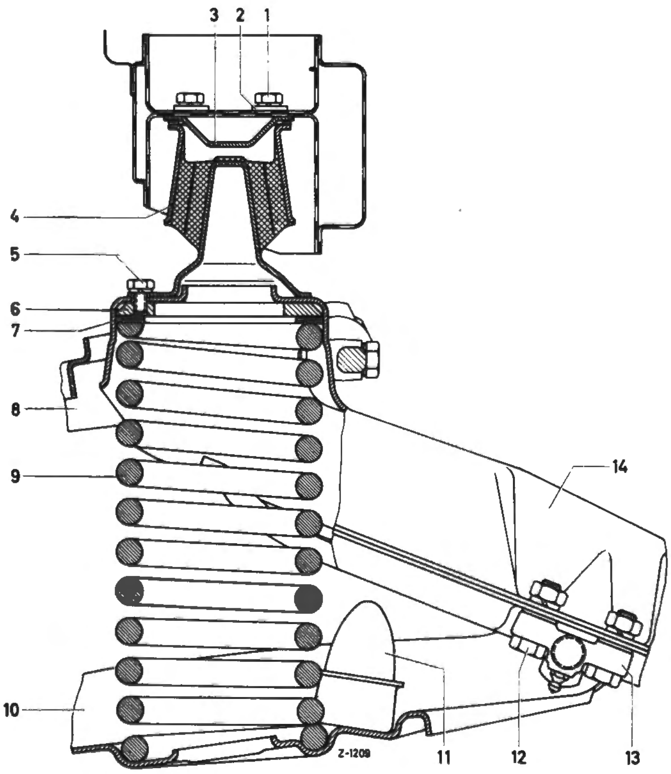


Fig. 32-4/3

1 Hexagon screws and lock washers for fastening the rubber mounting to the chassis base panel
2 Washers
3 Stop cup on chassis base panel
4 Rubber mounting for the front axle support
5 Hexagon screws and lock washers for fastening the rubber mounting to the front axle support
6 Threaded ring
7 Rubber washer
8 Upper control arm
9 Front spring
10 Lower control arm
11 Rubber buffer
12 Hexagon screws M 12×1.5×38 with nuts and lock washers
13 Pivot pin for lower control arm
14 Front axle support

When repairs are carried out, fit the hexagon screws (12) with the head upward.
Use only specified screws and nuts (see Job No. 33-0).

10. Remove the two Guides (5) 120 589 01 31, since now the lower control arm pivot pin is properly centered through the two guide pins of the cradle.

11. Insert the two inner hexagon screws (12) from above and tighten with hexagon nut and lock washer.

Note: When repairs are carried out, the hexagon screws are fited with the head upward and not as shown in Fig. 32-4/3 with the head downward.

12. Let down the jack and fit the two outer hexagon screws (see Job No. 33-0 for specified torque).

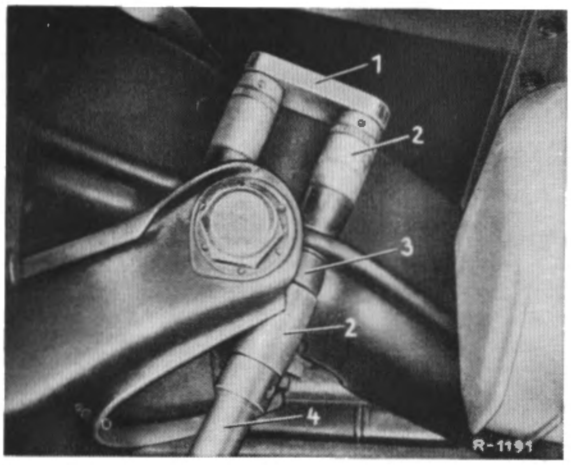


Fig. 32-4/5

1 Retaining plate
2 Socket 19 mm SW
3 Pivot pin for lever control arm
4 Torque wrench

Note: In order to prevent the hexagon screws from turning when being tightened, install two wrench sockets (2) (19 mm SW, 1/2"□) from above; the two sockets should be connected by a retaining plate (1) and two square adapters (Fig. 32-4/5).

The retaining plate can be made from flat steel in accordance with the sketch below (Fig. 32-4/6).

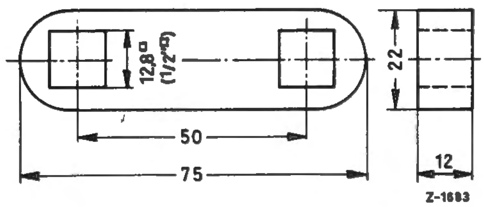


Fig. 32-4/6

13. Install the front shock-absorber (see Job No. 32-2).

14. Attach the torsion bar to the lower control arm (see Job No. 32-6).

15. Fit the front wheel, and the brake drum on cars with drum brakes, lower the car and tighten up the wheel nuts.

16. Check the front wheel camber and toe-in and if necessary correct (see Job No. 40-3).

17. Check the headlight adjustment (see Job No. 82-2).

B. Cars with 2nd Version Front Axle Support

The removal and installation procedures for the front springs are the same as on cars with 1st version front axle support.

Whereas cars with 1st version front axle support have springs with faced upper coil ends and smooth rubber washers, cars with 2nd version front axle support have springs with non-faced upper coil ends and the springs are centered by rubber mountings fitting the coil end (Fig. 32-4/7).

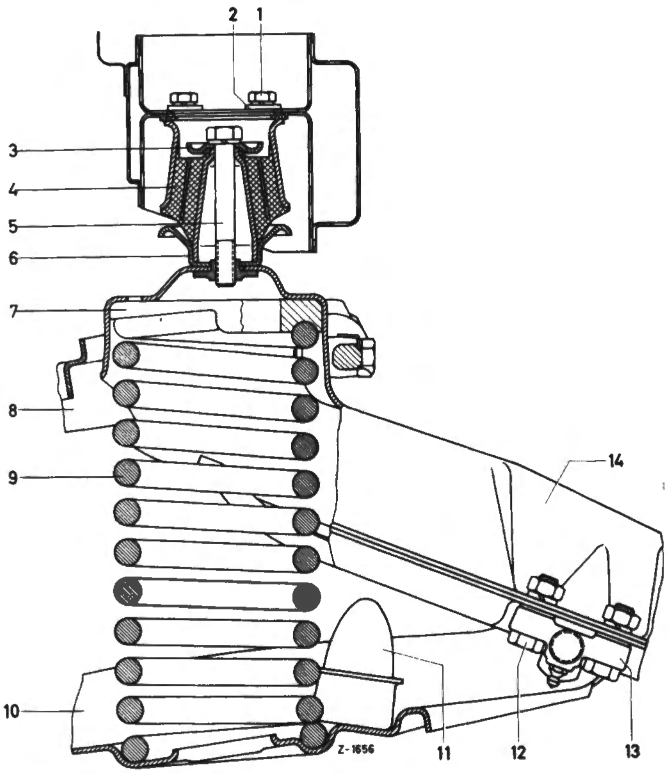


Fig. 32-4/7

1 Hexagon screws and lock washers for fastening the rubber mounting to the chassis base panel
2 Washers
3 Stop cup
4 Rubber mounting for the front axle support
5 Hexagon screw and lock washer for fastening the rubber mounting to the front axle support
6 Cup for rubber mounting
7 Rubber mounting
8 Upper control arm
9 Front spring
10 Lower control arm
11 Rubber buffer
12 Hexagon screws M 12×1.5×38 with nuts and lock washers
13 Pivot pin for lower control arm
14 Front axle support

When repairs are carried out, fit the hexagon screws (12) with the head upward.

Use only specified screws and nuts (see Job No. 33-0).

Note: The various spring lengths and trim dimensions of the front springs are compensated by rubber washers of different thickness (see Job No. 32-0).

*) When mounting the spring pay attention to the difference between top and bottom coil ends (Fig. 32-4/8).

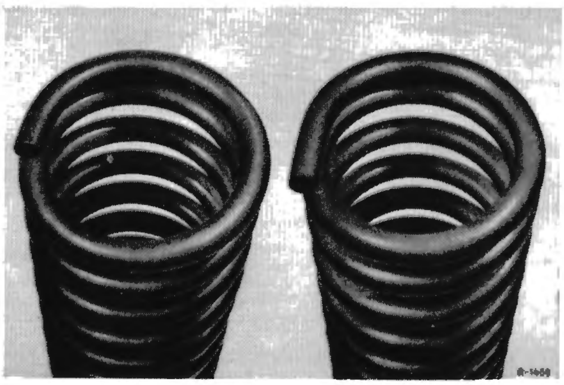


Fig. 32-4/8

top bottom

Removal and Installation of Rear Spring

Job No.
32-5

Modification: a number of minor changes

Removal:

1. Support the car at the rear, and remove the rear wheel.

2. Slightly raise the axle tube by means of the jack (Fig. 32-5/2).

Note: When raising the axle tube, the jack can be placed either under the torque arm or, together with Flange 111 589 01 63 (5), under the rear axle shaft (Fig. 32-5/2).

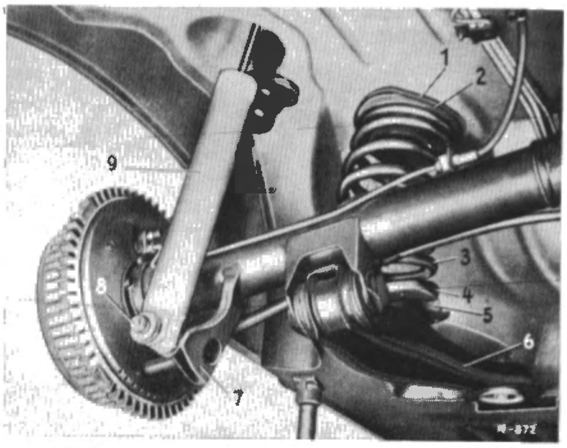


Fig. 32-5/1

1 Upper spring plate on chassis base panel
2 Upper rubber mounting
3 Rear spring
4 Lower rubber mounting
5 Lower spring plate
6 Torque arm
7 Support for lower shock-absorber suspension
8 Lower shock-absorber suspension
9 Rear shock-absorber

3. Install two Spring Tensioners 111 589 04 31 (Fig. 32-5/2). Then raise the axle tube further, taking care to ensure that the car is not lifted off the trestles. Then use the spring tensioners to compress the rear spring a little further.

4. Lower the axle tube with the jack, and remove the upper rubber mounting and the spring together with the spring tensioners (Fig. 32-5/3).

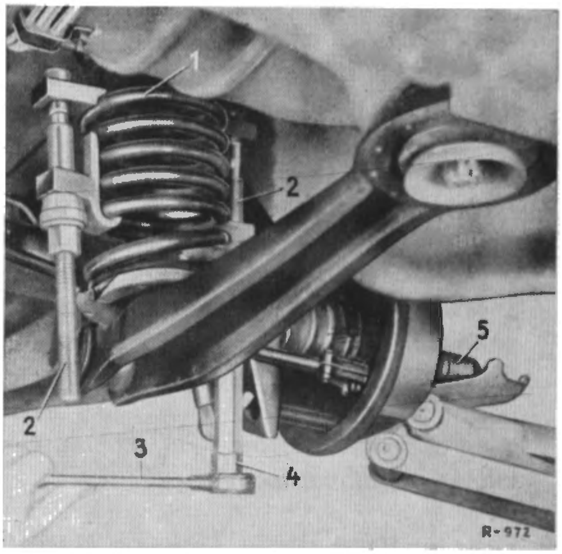


Fig. 32-5/2

1 Rear spring
2 Spring Tensioner 111 589 04 31
3 Ratchet ½" square
4 Hexagon Special Socket 24 mm 111 569 01 09
5 Flange 111 589 01 63

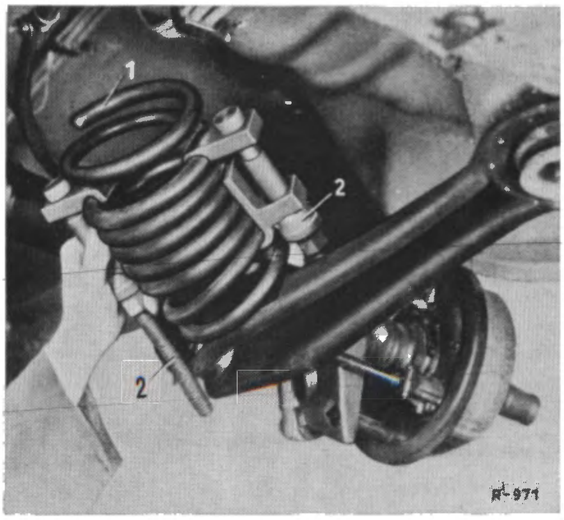


Fig. 32-5/3

1 Rear spring
2 Spring Tensioner 111 589 04 31

Note: The axle tube should only be lowered completely if the rear shock-absorber is installed, since the shock-absorber serves at the same time as a spring stop for the rear wheels. If the shock-absorber has been removed, the axle tube must be supported.

5. If the rear spring is being replaced, put the top coil of the spring in a vise and release the spring tensioners evenly.

Installation:

6. Use the Spring Tensioners 111 589 04 31 to compress the rear spring in a vise, taking care to ensure that the spring tensioners are fitted so that they are not in the way when the spring is installed.

7. Check the upper and lower rubber mountings and the upper spring plate at the chassis base panel and the lower spring plate at the torque arm. Make sure that the lower spring plate (5) is correctly positioned in accordance with the color code of the rear springs (Fig. 32-5/4). Rub talc on the rubber mountings.

8. Place the lower rubber mounting (4) in the spring plate (5). Attach the upper rubber mounting (2) to the spring by means of masking tape. Install the rear spring in the tensioners (Fig. 32-5/4).

Note: The left and right rear springs are exactly alike.

Corresponding to the color coding on the springs, the various trim dimensions of the rear springs are compensated by adjusting the lower spring plate and by installing different upper rubber mountings. For this purpose, three positions of the spring plate and three upper mountings of different height are available.

The numbers 1, 2, and 3 punched in at the screw holes in the lower spring plate indicate the individual positions of the spring plate (see Table "Color Code for Springs" in Job No. 32-0). Position 1 is the highest stage and position 3 the lowest stage. The various positions of the spring plate and the different upper rubber mountings serve the double purpose of correcting the differing trim dimensions of the rear spring and of adjusting the camber of the rear wheel (see Job No. 40-3).

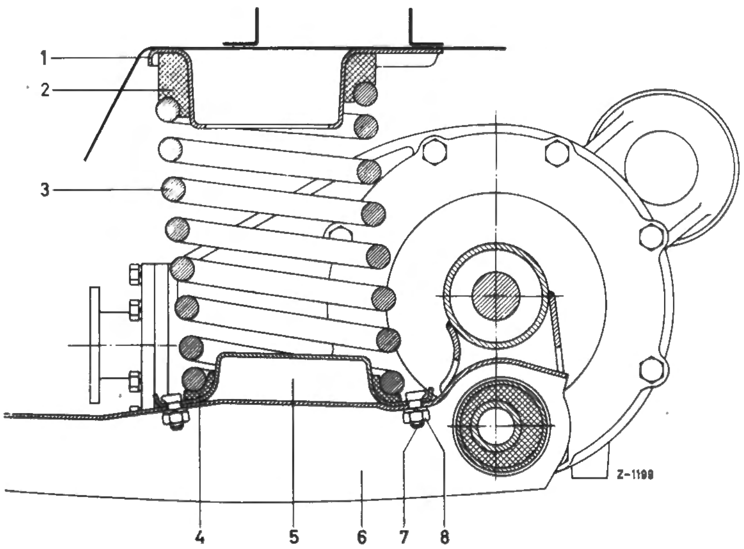


Fig. 32-5/4

1 Upper spring plate on chassis base panel
2 Upper rubber mounting
3 Rear spring
4 Lower rubber mounting
5 Lower spring plate
6 Torque arm
7 Screw for attaching the spring plate to the torque arm
8 Hexagon nuts and lock washers

9. Raise the axle tube, making sure that the ends of the spring are correctly seated at the top and the botton. Then release the spring tensioners, lower the axle tube and remove the spring tensioners (Fig. 32-5/1).

10. Fit the rear wheel, lower the car, and tighten up the wheel nuts.

11. Check the rear wheel camber (see Job No. 40-3).

Removal and Installation of Torsion Bar for Front Axle

Job No.
32-6

Modification: 2nd version front axle (Addition)

A. 1st Version Front Axle

Removal:

1. Detach the torsion bar (12) mounting from the lower control arm (19) at the right and at the left. Remove the hexagon nuts, pull out the hexagon screw (16), and remove the cup washers, the rubber buffers and the spacer tube (Figs. 32-6/1 and 32-6/2).

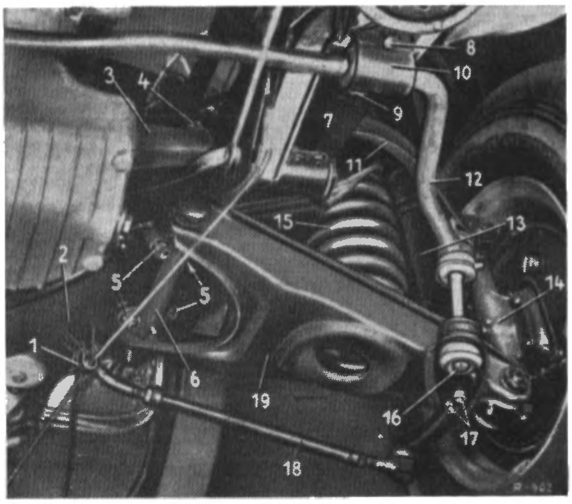


Fig. 32-6/1

1 Cable guide at front axle support
2 Front axle support
3 Engines support
4 Hexagon screw and spring washer
5 Hexagon screws with nuts and lock washers for fastening the pivot pin to the front axle support
6 Pivot pin for lower control arm
7 Flat spring supporting the front axle support
8 Hexagon screw (M 12×1.5×25) with lock washer
9 Hexagon screw (M 14×1.5×25) with lock washer
10 Rubber mounting for torsion bar
11 Upper control arm
12 Torsion bar
13 Front shock-absorber
14 Steering knuckle
15 Front spring
16 Hexagon screw for fastening the torsion bar to the lower control arm
17 Hexagon nuts with lock washers for fastening the lower shock-absorber suspension
18 Tie-rod
19 Lower control arm

2. Unscrew the hexagon screws (8) and (9) for fastening the rubber mountings (10) for the torsion bar (12) to the chassis base panel at the left and at the right and remove the torsion bar together with the brackets, the rubber mountings, and the locking plates (Fig. 32-6/1).

Installation:

3. Check the two rubber mountings (12), the rubber buffers (3) and the hexagon screws (4) together with the cup washers (2) and the spacer tubes (5) (Fig. 32-6/2).
4. Slide the rubber mountings (12) over the torsion bar. Fix the torsion bar to the chassis base panel at the left and at the right together with the flat springs (Fig. 32-5/2). In doing this make sure that the rubber mountings are properly seated in the brackets. Tighten the hexagon screws with the specified tightening torque (see Job No. 33-0).

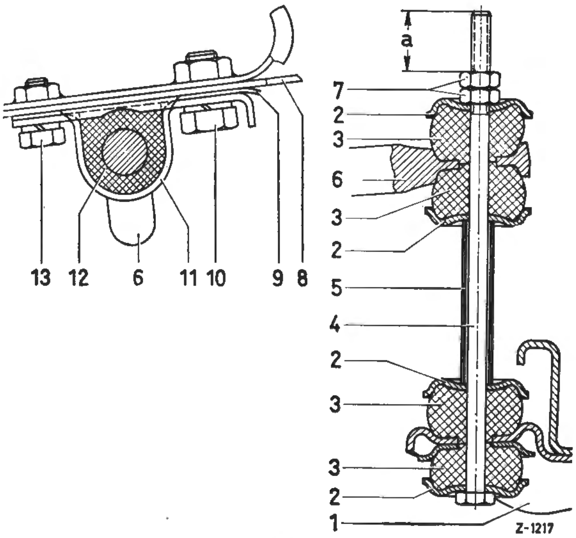


Fig. 32-6/2

1 Lower control arm
2 Cup washer
3 Rubber buffer
4 Hexagon screw
5 Spacer tube
6 Torsion bar
7 Hexagon nut
8 Flat spring
9 Locking plate
10 Hexagon screw (M 14×1.5) and lock washer
11 Bracket for rubber mounting
12 Rubber mounting
13 Hexagon screw

5. Fasten the torsion bar to the lower control arm, taking care to ensure that the rubber buffers and the cup washers are properly arranged. Screw on the hexagon nuts (7) in such a way that the prescribed initial stress of the rubber buffers is obtained. For this purpose measure the distance "a" from the screw end to the upper hexagon nut. (For dimensions see Table in Job No. 32-0). Then lock the two hexagon nuts (Fig. 32-6/2).

B. 2nd Version Front Axle

Removal:

1. Detach the torsion bar mounting from the lower control arms. To do this unscrew the hexagon nuts, pull out the hexagon screw (16) and remove the cup washers, the rubber buffers, and the spacer tubes (Figs. 32-6/3 and 5).

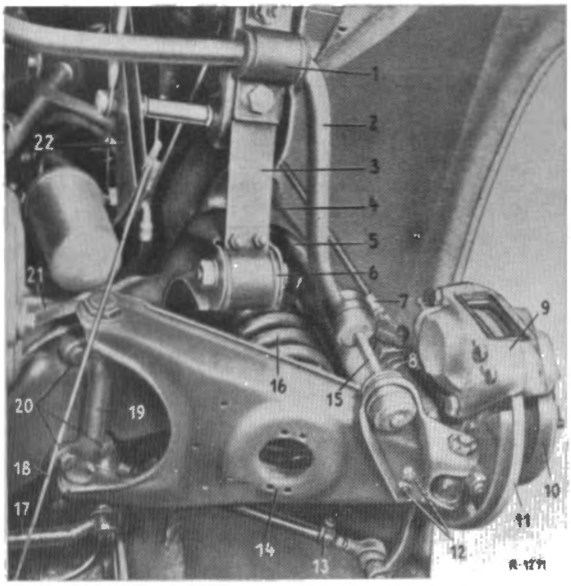


Fig. 32-6/3

1 Torsion bar mounting and flat spring on chassis base panel
2 Torsion bar
3 Flat spring
4 Shock absorber
5 Upper control arm
6 Flat spring mounting on front axle support
7 Brake hose
8 Steering knuckle
9 Brake caliper
10 Front wheel hub
11 Brake disk
12 Lower shock absorber suspension
13 Tie-rod
14 Lower control arm
15 Torsion bar mounting on lower control arm
16 Front spring
17 Center tie-rod
18 Center brake cable
19 Pivot pin
20 Hexagon screw for fastening the pivot pin for the lower control arm
21 Engine support
22 Hand-brake lever

2. Use a scriber to mark the position of the flat springs on the chassis base panel left and right. Unscrew the flat springs from the chassis base panel together with the brackets for the rubber mountings of the torsion bar (Fig. 32-6/4). Remove the torsion bar.

Installation:

3. Check the rubber mountings (10), the rubber buffers (3), and the hexagon screws (4) with the cup washers (2) and the spacer tubes (5) (Figs. 32-6/4 and 5).

4. Rub the rubber mountings (10) with talc and slide them over the torsion bar. Fix the torsion bar to the chassis base panel at the left and at the right together with the flat spring (Fig. 32-6/4). Pay attention to the positions marked during removal. For the specified tightening torque see Job No. 33-0.

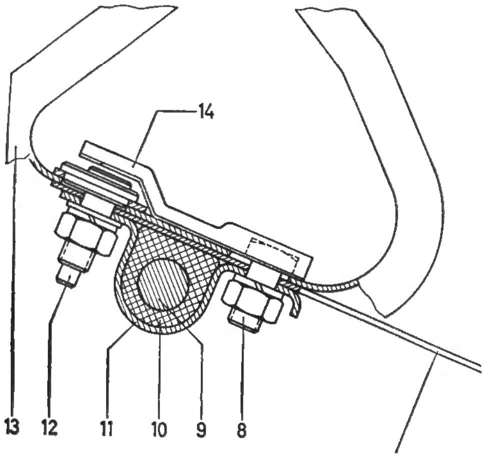


Fig. 32-6/4

7 Flat spring for front axle longitudinal support
8 Square screw with nut and lock washer
9 Torsion bar
10 Rubber mounting for torsion bar
11 Bracket for rubber mounting
12 Eccentric with hexagon nut and lock washer
13 Bearing bracket on chassis base panel
14 Cage for square screw and eccentric

5. Fasten the torsion bar to the lower control arms taking care to ensure that the rubber buffers and the cup washers are properly arranged. Screw on the hexagon nuts (7) in such a way that the prescribed initial stress of the rubber buffers is obtained; for this purpose measure the distance "a" from the screw end to the upper hexagon nut. (For dimensions see Table in Job No. 32-0). Then lock the two hexagon nuts (Fig. 32-6/5).

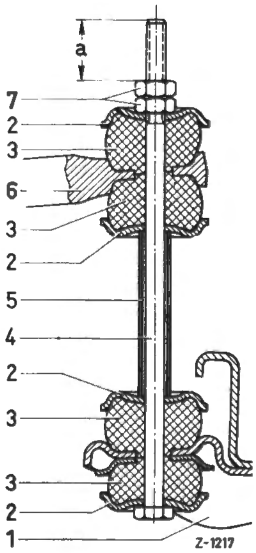


Fig. 32-6/5

1 Lower control arm
2 Cup washer
3 Rubber buffer
4 Hexagon screw
5 Spacer tube
6 Torsion bar
7 Hexagon nuts

Removal and Installation of Compensating Spring

Job No.
32-7

Removal:

1. Support the car at the rear.

Note: The compensating spring should only be removed when there is no pressure on the axle tube.

2. Insert Spring Tensioner 111 589 00 31 (Fig. 37-7/2) and compress the compensating spring (3) until there is no pressure on the bracket (5) on the right axle tube (Fig. 32-7/1).

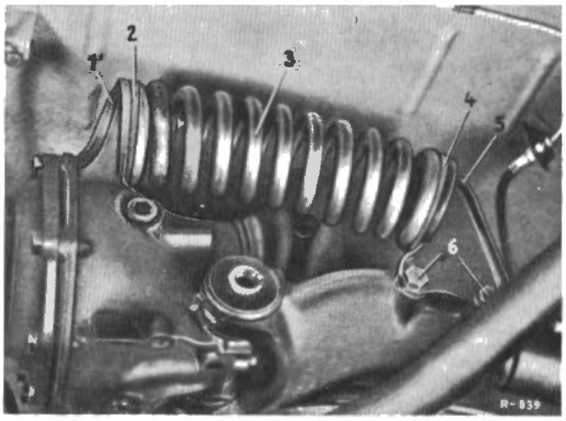


Fig. 32-7/1

1 Bracket on rear axle housing
2 Rubber ring left
3 Compensating spring
4 Rubber ring right
5 Bracket on right axle tube
6 Hexagon screws for fastening the bracket to the axle tube

3. Unscrew the two hexagon fixing screws (6) for the bracket. Then remove the bracket and the compensating spring (Figs. 32-7/1 and 32-7/2).

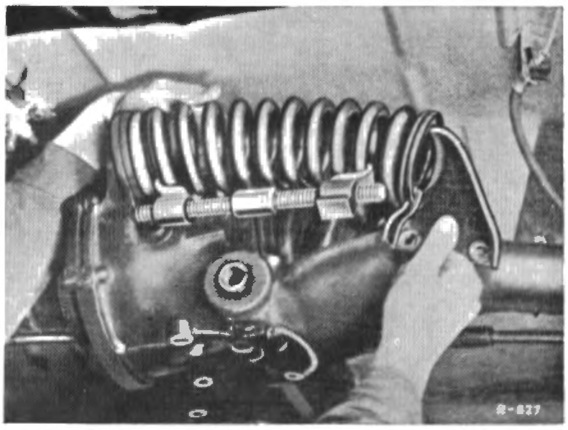


Fig. 32-7/2

Installation:

4. Check the two rubber rings (2) and (4) and the bracket (5) (Fig. 32-7/1).

Note: In the case of the compensating spring, the various trim dimensions are compensated by rubber rings of different height (see Job No. 32-0).

5. Mount the bracket loosely by means of the inner of the two hexagon screws (6) and slightly move it to the outside. Insert the compensating spring with the tensioner installed, move the bracket to the inside and screw it on (for specified tightening torque for the hexagon screws see Job No. 32-0). Release and remove the spring tensioner, making sure that the spring is perfectly seated in the rubber rings.

Testing of Shock-Absorbers

Job No.
32-8

A. General

If the riding properties of the car change and if there is a good reason for suspecting the shock-absorbers, these should be removed and tested on a testing machine.

The test values are given in the table in Job No. 32-0. Testing a shock-absorber by hand is an extremely inaccurate method and does not therefore permit any conclusions as to the condition and the adjustment of the shock-absorber.

If rattling noises are heard on the road at the front or rear axle, the suspension members of the shock-absorbers should be checked first of all (see Job Nos. 32-2 and 32-3).

If a grunting noise is heard when rocking the car, entering it or driving it at low speed, the piston rods are running dry. They should be cleaned and oiled.

Note: Shock-absorbers should be treated with great care to avoid any deformation of the housing or bending and damaging of the piston rod.

Shock-absorbers cannot be repaired with standard shop tools; repairs should not be attempted if the special tools and equipment required are not available.

Because of the gas pressure obtaining inside the Bilstein shock-absorbers, they must under no circumstances ever be opened.

As a safety precaution, unserviceable Bilstein shock-absorbers ready for scrapping should have a hole drilled into the lower end of the housing to release the gas.

B. Checking the Oil Reserve in the Shock-Absorber

Bilstein Shock-Absorbers

In the case of the gas-filled Bilstein shock-absorbers it is possible to make an accurate check on the oil reserve in the shock-absorber. To do this, fix the shock-absorber in a vise at the lower suspension element, depress the piston rod down to the stop and measure the distance between the collar on the piston rod and the shock-absorber housing (see Fig. 32-0/4).

The end position of the piston rod and the position of the compensating piston between gas pad and oil depends on the quanity of oil in the shock-absorber. If there is a loss of oil, the gas pressure forces the compensating piston outward which increases the piston rod extrusion.

The table in Job No. 32-0 lists the permissible values for new and for used shock-absorbers. Used shock-absorbers which exceed the maximum values given in the table must be replaced.

Note:

a) When measuring the oil reserve, the shock-absorber temperature should be about + 20° C.

b) If a shock-absorber is found to have an outside oil film, the oil reserve should be checked. If the piston rod extrusion is found to be within the permissible limits and the shock-absorber is working properly, it should be reinstalled after cleaning. There is no point in replacing a shock-absorber only because of a slight loss of oil.

c) If the piston rod seizes when it is pressed down or if the piston rod does not automatically return to its initial position when the shock-absorber is compressed by hand, the shock-absorber is obviously not in proper working order and is no longer serviceable.

d) The shock-absorber should be replaced if a whistling or clicking noise is heard during the last quarter of the working stroke before the bottom stop when the piston rod is pressed down. The same noise occurs when the piston rod extrusion exceeds the maximum permissible value.

F. & S. Shock-Absorbers

In the case of F. & S. shock-absorbers a major loss of oil is definitely established if there is non-productive travel of the piston rod in the upper quarter of the working stroke when the piston rod is moved up and down several times. In that case the shock-absorber is no longer fully serviceable.

Stabilus Shock-Absorbers

In the case of Stabilus shock-absorbers there is a loss of oil if the piston rod projects from the housing in the lower stop position when pressed down. Within certain limits, oil losses in these shock-absorbers are compensated by a pressure spring at the bottom of the housing which acts upon a compensating piston, with the result that small oil losses do not make the shock-absorber inoperative.

Removal and Installation of Torsion Bar for Rear Axle

Job No.
32-9

Modification: Paras 1—3 new

Removal:

1. Leave the valve knob in "driving position".
2. Jack up the car at the rear.
3. Check by finger pressure whether the rear bellows are deflated.
4. Detach the connecting rod (10) for the leveling valve (8) from the lever (7a) of the torsion bar (Fig. 32-9/1). Fix the leveling valve in its neutral position by means of a pin (see Fig. 40-5/4).

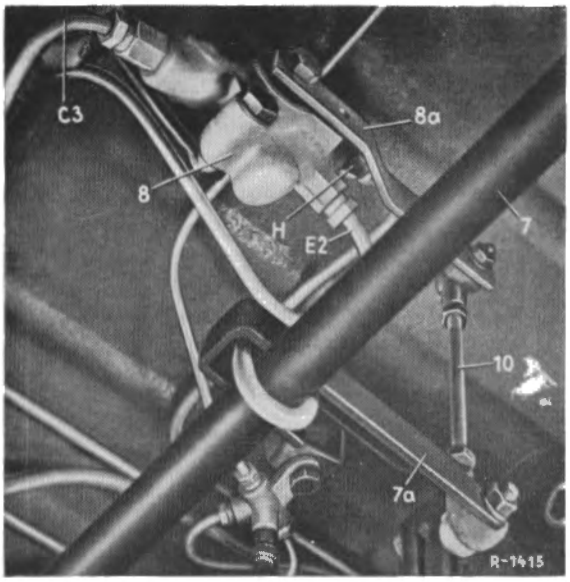


Fig. 32-9/1

C 3 Pressure line (full working pressure) from valve unit to rear leveling valve
E 2 Connecting line from rear leveling valve to air chamber
H Exhaust line from rear leveling valve to valve unit
7 Torsion bar for rear axle
7a Lever on torsion bar
8 Rear leveling valve
8a Lever
10 Connecting rod

5. Detach lower clamp (5) from bracket (6) carrying the torsion bar on the chassis base panel at the left and right (Fig. 32-9/2).
6. Detach lower right shock-absorber suspension and remove shock-absorber from bearing bracket (Fig. 32-9/3). (See also Job No. 32-3).

Note: Make sure that the shock-absorber suspension is only detached when the bellows are deflated!

7. Unscrew the three hexagon screws fastening the bearing bracket (3) to the right axle tube and remove the connecting brace (4) (Fig. 32-9/3).

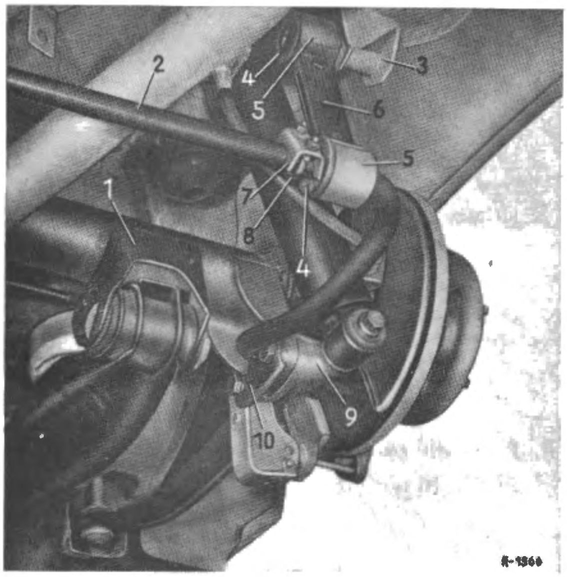


Fig. 32-9/2

1 Axle tube of rear axle
2 Torsion bar
3 Bracket on chassis base panel
4 Rubber mounting
5 Clamp
6 Bracket
7 Retainer
8 Fixing strap
9 Bearing bracket
10 Connecting brace

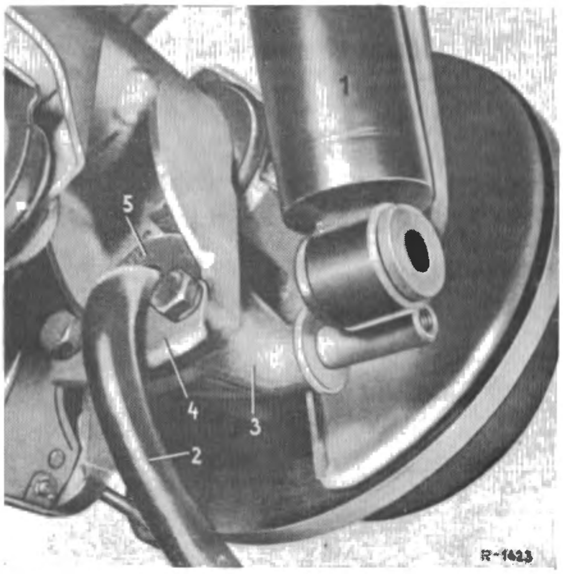


Fig. 32-9/3

1 Rear shock-absorber
2 Torsion bar
3 Bearing bracket
4 Connecting brace
5 Rubber mounting

32-9/1

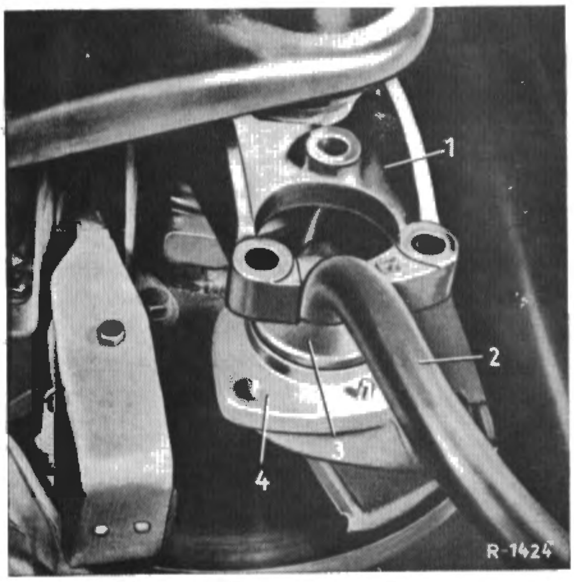


Fig. 32-9/4

1 Right axle tube of rear axle
2 Torsion bar
3 Rubber mounting
4 Right bearing bracket

8. Press the torsion bar off the right axle tube of the rear axle (Fig. 32-9/4).

9. Pull the torsion bar out of the rubber mounting in the left bearing bracket (6) and remove (Fig. 32-9/5). Remove the right bearing bracket (1) from the torsion bar.

10. If necessary, unscrew the lever (7a) for the leveling valve from the torsion bar (Fig. 32-9/1). Press the clamp (5) for the rubber mounting (4) on the chassis base panel off the torsion bar at the right and at the left and remove the rubber mounting. Remove the retainer (7) together with the fixing strap (8) (Fig. 32-9/2).

Installation:

11. Check the rubber mountings carrying the torsion bar for the rear axle. If necessary, press the rubber mountings off the bearing brackets and replace them.

Note: On installation make sure that the slot in the rubber mounting points either front or rear; in no case should it point up or down.

12. Check the rubber mountings carrying the torsion bar on the chassis base panel and, if necessary, replace them. Push the rubber mountings onto the torsion bar at the right and at the left and attach the clamps.

13. Insert the torsion bar in the rubber mounting in the left bearing bracket. Slide on the right bearing bracket and insert the torsion bar through the slot in the right axle tube (Figs. 32-9/4 and 5).

14. Screw the right bearing bracket together with the connecting brace (4) to the axle tube (Fig. 32-9/3). With the car jacked up slightly raise the right axle tube of the rear axle during the process.

15. Intall the right lower shock-absorber suspension (see Job No. 32-3).

16. Attach the torsion bar to the bearing bracket on the chassis base panel. If the retainers (7) had been detached previously, align the torsion bar and mount the retainers and fixing straps in such a way that they rest against the inner side of the rubber mountings without any play (Fig. 32-9/2).

17. Attach the lever for the leveling valve to the torsion bar. Adjust the car level (see Job No. 40-5).

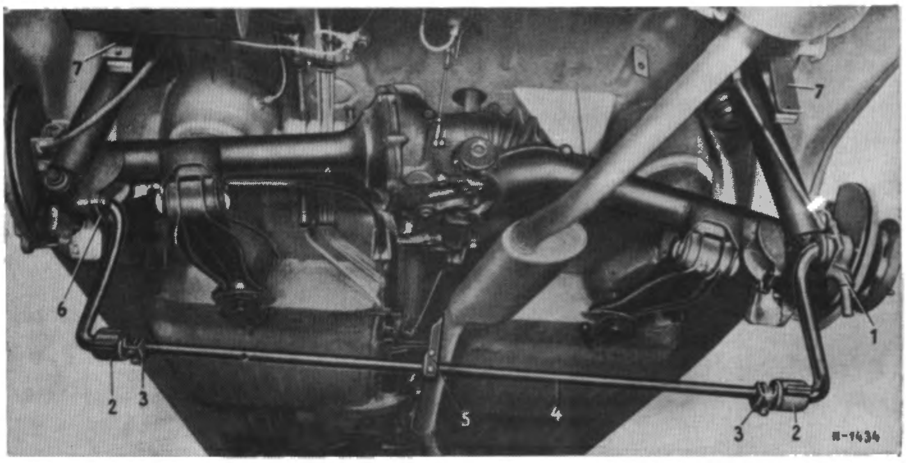


Fig. 32-9/5

1 Right bearing bracket with rubber mounting
2 Clamp with rubber mounting
3 Retainer with fixing strap
4 Torsion bar
5 Lever for leveling valve
6 Left bearing bracket
7 Bracket

Hints for Assembly Work on Cars with Air Suspension System

Job No.
32-11

A. Removal and Installation of Front Shock-Absorber

(see Job No. 32-2)

1. Leave push-pull button for valve unit in 'Drive Position'.
2. Jack up the car at the front.
3. Replace shock-absorber.
4. Jack the car down (Caution! Car has very little ground clearance at the front).

B. Removal and Installation of Rear Shock-Absorber

(see Job Nr. 32-3)

1. Leave push-pull button for valve unit in 'Drive Position'.
2. Jack up the car at the rear.
3. Check by finger-pressure whether the rear bellows are evacuated.
4. Replace shock-absorber.
5. Jack the car down (Caution! Car has very little ground clearance at the rear).

C. Removal and Installation of Front Axle Support with Front Axle Halves

(see Job No. 33-1)

1. Leave push-pull button for valve unit in 'Drive Position'.
2. Jack up the car at the front.
3. Completely drain compressed air from the air reservoir.
4. Disconnect both compressed-air hoses at the left leveling valve.
5. Remove front axle support with front axle halves.

Note: The front axle has to be removed together with air chambers bellows, and spring pistons.

6. Install front axle support with front axle halves.
7. Connect compressed-air hoses.
8. Jack the car down (Caution! Car has very little ground clearance at the front).
9. Fill the system with compressed air (see Job No. 32-12).
10. Adjust car level at the front axle (see Job No. 40-5).

D. Removal and Installation of Steering Knuckle

(see Job No. 33-6)

1. Leave push-pull button for valve unit in 'Drive Position'.
2. Jack up the car at the front.
3. Completely drain compressed air from the air reservoir.
4. Open screw plug 'V' at the valve unit and close after the air has been blown off.

5. Remove front shock-absorber (see Job No. 32-2).
6. Detach connecting rod for front leveling valve at the lower control arm. To do this, unscrew ball pin.
7. Replace steering knuckle.
8. Install front shock-absorber (see Job No. 32-2).
9. Attach connecting rod for front leveling valve.
10. Jack the car down (Caution! Car has very little ground clearance at the front).

E. Removal and Installation of Rear Axle

(see Job No. 35-1)

1. Leave push-pull button for valve unit in 'Drive Position'.
2. Jack up the car at the rear.
3. Completely drain compressed air from the air reservoir.
4. Check by finger-pressure whether the rear bellows are evacuated.
5. Loosen the hexagon screws fastening the spring pistons to the torque arms.
6. Detach the connecting rod for the rear leveling valve from the lever of the torsion bar. To do this, unscrew ball pin.
7. Remove the torsion bar (see Job No. 32-9).
8. Remove the rear axle.

Note: When the rear axle is being removed, the spring pistons are left in the bellows.

9. Install rear axle.
10. Install torsion bar (see Job No. 32-9).
11. Fix the lever of the leveling valve in the neutral position.
12. Fill up the system with compressed air (see Job No. 32-12).
13. Fill the rear bellows (see Job No. 32-12).
14. Jack the car down (Caution! Car has not full ground clearance).
15. Adjust the car level at the rear axle (see Job No. 40-5).

F. Removal and Installation of Torque Arm on Rear Axle

(see Job No. 35-2)

For the removal and installation of the torque arm see procedures 1 to 6 and 11 to 15 of Section E.

Maintenance and Assembly Work on Air Suspension System

Job No.
32-12

A. General Instructions

Jacking up of Car

Before the car is jacked up for a wheel change, for installing or removing snow chains, or for general maintenance and assembly operations, during which the shock absorbers are not removed, the push-pull button for the valve unit must be pulled out (position "Wheel Change"). This is necessary in order to prevent air loss. If the push-pull button is left in "Drive Position" (pushed in) the air is released from the bellows when the car is being jacked up so that as a result the ground clearance of the car will be **too low** after it has been jacked down.

When jacking up the car, place the jack as usual under the front axle support and at the rear under the rear axle housing. **If the car is jacked down when the bellows are empty, do not pull out the jack before the standard design height of the car has been reached.** This is particularly important for the rear axle since otherwise the leveling valve will be damaged.

When the car is being lifted on one side by means of the car jack or by a workshop jack, the hand brake must not be applied. The selector lever should be in position "P". The front wheel opposite the side which is being jacked up should be secured by chocks front and rear.

Filling the System with Compressed Air

Connect the air reservoir via the filler valve (2) to the stationary workshop compressed-air system and fill up until a pressure of approx. 10 atm is reached (Fig. 32-12/1).

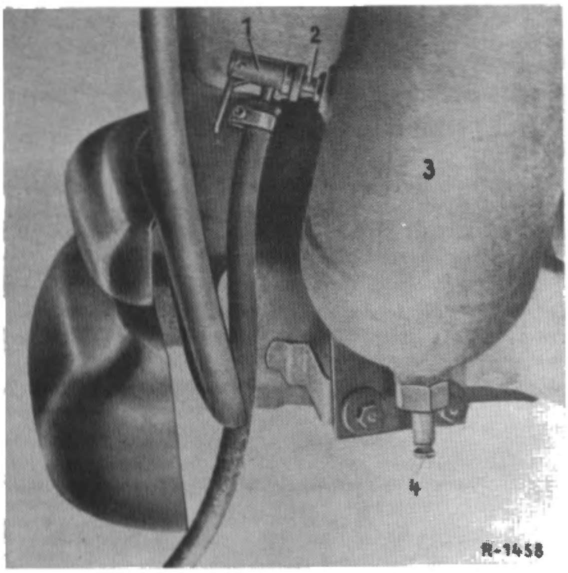


Fig. 32-12/1

1 Connecting piece on air hose
2 Filler valve
3 Air reservoir
4 Drain valve

Note: If there is a slight loss of air, fill up the air suspension system by running the engine at moderate speed (n=approx. 2000 rpm).

When filling up the air reservoir from the stationary compressed-air installation, make sure that no condensation enters the air suspension system.

Checking Working Pressure

Connect a suitable pressure gage to measure the pressure on the filler valve of the air reservoir (Fig. 32-12/2).

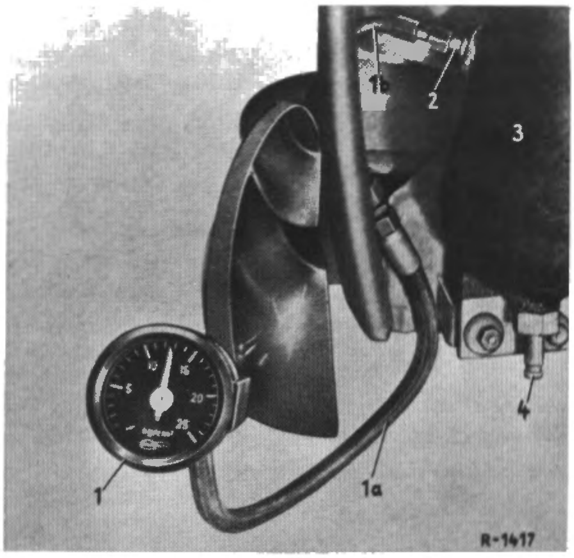


Fig. 32-12/2

1 Pressure gage
1a Connecting hose
1b Connecting piece
2 Filler valve
3 Air reservoir
4 Drain valve

Assembly Work on Air Suspension Units

Caution, compressed air is dangerous! High pressure!

To prevent accidents, the car should be jacked up before the air lines on the leveling valves and air chambers are disconnected!

Extreme cleanliness is absolutely essential for all assembly work!

On no account must dirt or water get into the units and lines of the air suspension system!

Dirty line connections must be cleaned before the lines are disconnected!

Lines, hoses and all other connections must be closed immediately after disconnection!

Carefully clean all lines with dry compressed air before reconnecting them and carefully clean new lines before connecting them!

Always use new rubber sealing rings for all line connections!

Make sure that the rubber sealing rings for the air lines are properly seated in the threaded unions! (Fig. 32-12/3).

Tighten the cap screws of the lines with the prescribed torque! (see Job No. 32-0).

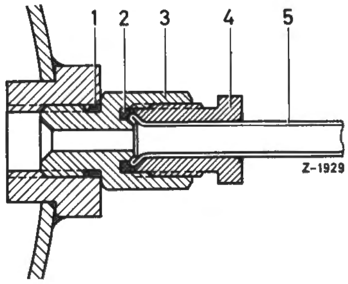


Fig. 32-12/3

Line connection

1 Rubber sealing ring for threaded union
2 Rubber sealing ring for air line
3 Threaded union
4 Cap screw
5 Air line

Checking System for Leaks

After reassembly all connections should always be checked for leaks by spraying with a special solution as described below. Leaks will be indicated by the formation of bubbles (e.g. as shown in Fig. 32-12/4 – see Arow). For spraying use an oil gun with plastic container.

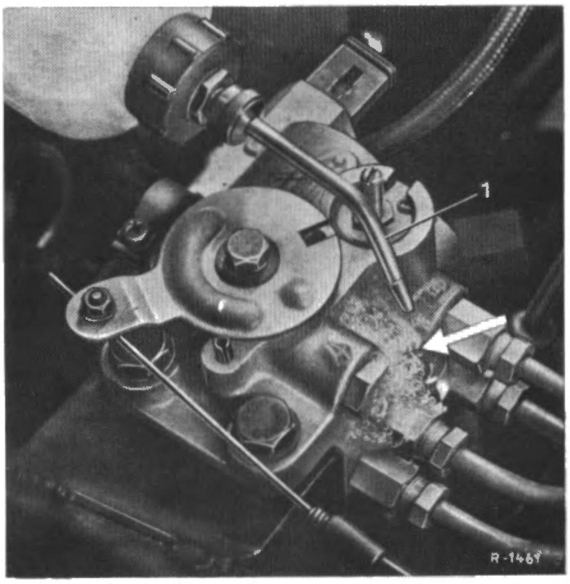


Fig. 32-12/4

1 Oil gun with plastic container

If there is any air loss all compressed-air connections should be checked in this way.

As a testing agent use water with the addition of Nekal BX Dry produced by the firm BASF, Ludwigshafen, according to their instructions. Maximum foam is produced at a concentration of two table- spoonfuls (approx. 12 to 15 gm.) of Nekal BX Dry to 1 liter of water.

To produce the mixture, dissolve the powder in 1/4 liter boiling water, stirring all the time until a clear liquid is produced. Then fill up the solution with the remaining 3/4 liters of cold water.

Filling of Rear Bellows

The operations described below apply to repair cases where the spring piston was **detached** from the bellows. Any bellows detached from the spring piston should only be filled **according to instructions,** that is, **in a horizontal position of the rear axle tubes,** since otherwise the bellows would not be centered correctly on the spring piston.

1. Detach the connecting rod of the rear leveling valve. To do this, unscrew the ball pin from the lever on the torsion bar (Fig. 32-12/6).
2. Lift both axle tubes in order to get them into an approximately horizontal position (Fig. 32-12/5).

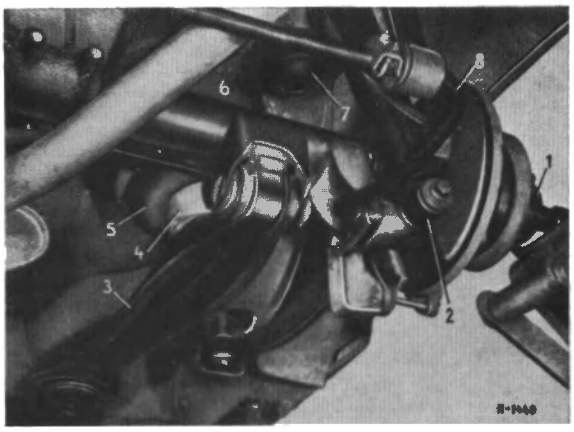


Fig. 32-12/5

1 Flange 111 589 01 63
2 Lower shock-absorber suspension
3 Torque arm
4 Spring piston
5 Bellows
6 Rear axle tube
7 Rubber buffer
8 Torsion bar

3. Fill up the air reservoir to a maximum of 8 atm.

   The rear bellows should never be filled unless the cross strut of the rear axle has been mounted and the system has been adjusted to the center position (see Job Nos. 35-1, and 40-3, Section H).
4. Coat the spring piston with glycerin at the upper end.
5. Fill the bellows to approx. 3 atm by lifting the lever on the leveling valve, taking care that the bellows are properly centered on the spring piston (Fig. 32-12/6). When the assembly is properly mounted, the bellows must rest evenly on the whole circumference of the spring piston.

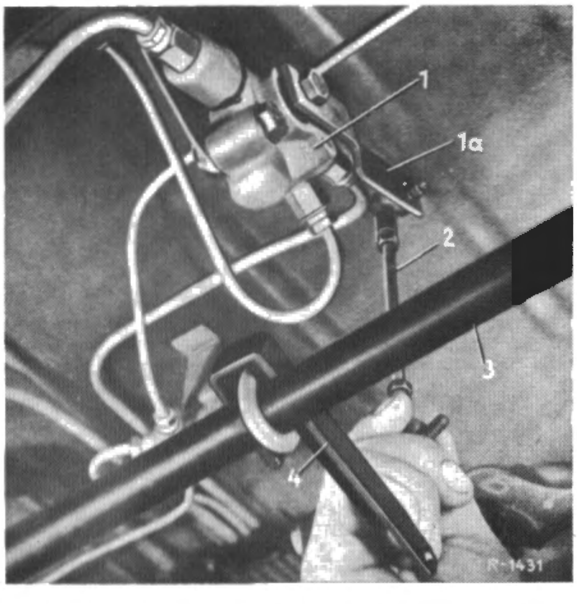


Fig. 32-12/6

1 Leveling valve
1a Lever
2 Connecting rod
3 Torsion bar
4 Lever on torsion bar

6. Pull the push-pull button for the valve unit to the position "Wheel Change" in order to ensure that during the jacking down of the car, air cannot escape from the bellows.

7. Jack car down (Caution! Car has not full ground clearance).

8. Attach the connecting rod of the leveling valve.

9. Press the push = pull button for the valve unit into "Drive Position".

Driving with Empty Bellows

If the car has to be driven or towed for some time with a defect in the air suspension system, the standard rubber buffers on the front and rear axles should be increased in height by installing additional rubber buffers in order to increase ground clearance (Figs. 32-12/7 and 8). The additional rubber buffers can be obtained through normal channels under the part numbers listed below.

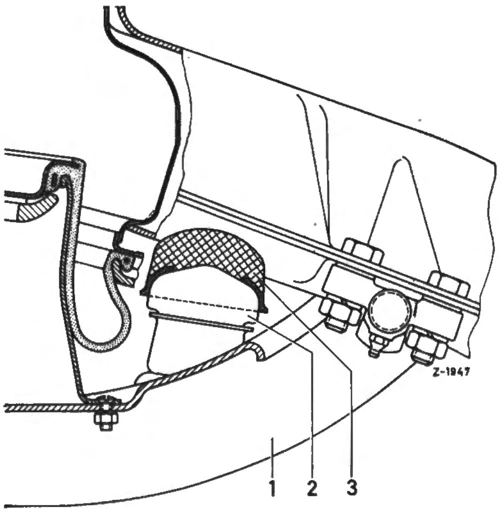


Fig. 32-12/7

Front axle

1 Lower control arm
2 Standard rubber buffer
3 Additional rubber buffer
112 589 02 63 00

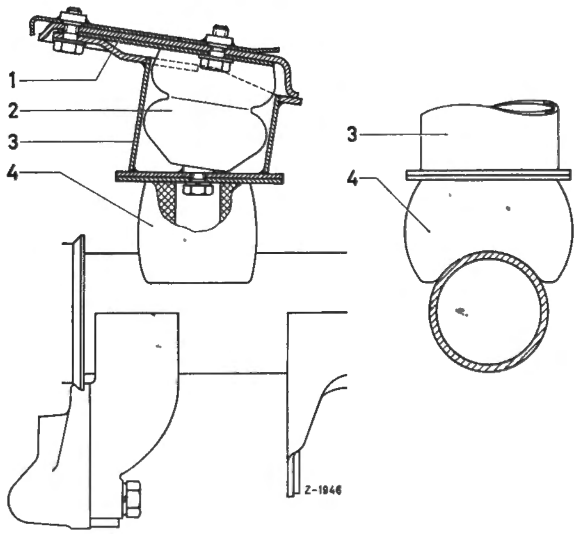


Fig. 32-12/8

Rear axle

1 Stop plate
2 Standard rubber buffer
3 Bracket on additional rubber buffer
4 Additional rubber buffer
with bracket 112 589 03 63 00

For the installation of additional rubber buffers (4 buffers on the front axle, 2 buffers on the rear axle) the car must be jacked up.

For lifting the car, put a workshop jack as usual under the front axle support or the rear axle housing. It is advisable to push the car wheels on a slight elevation in order to increase their ground clearance.

Note: Before the additional rubber buffers can be installed, both wheels on the front axle must be under no load at the same time. When the car has been jacked up by the car jack, first lift one side and support the car by a trestle under the chassis base panel; then jack up the other side in order to relieve the left and right wheel.

B. Maintenance Work

1. **After 300 miles (Schedule A), 1900 miles (Schedule B), and Every 1900 miles (Schedules C, D and E)** check the tension and the condition of the V-belt of the air compressor drive. If there is any wear, replace the belt. Belt pressure is correct when the belt with moderate thumb-pressure can be depressed by approx. 10-15 mm.
   To retension the V-belt, loosen the hexagon nut (4) on the bearing bracket (5) and tighten the tensioning screw (1) (Fig. 32-12/9). Afterwards tighten the lock nut of the tensioning screw and the hexagon nut on the bearing bracket.

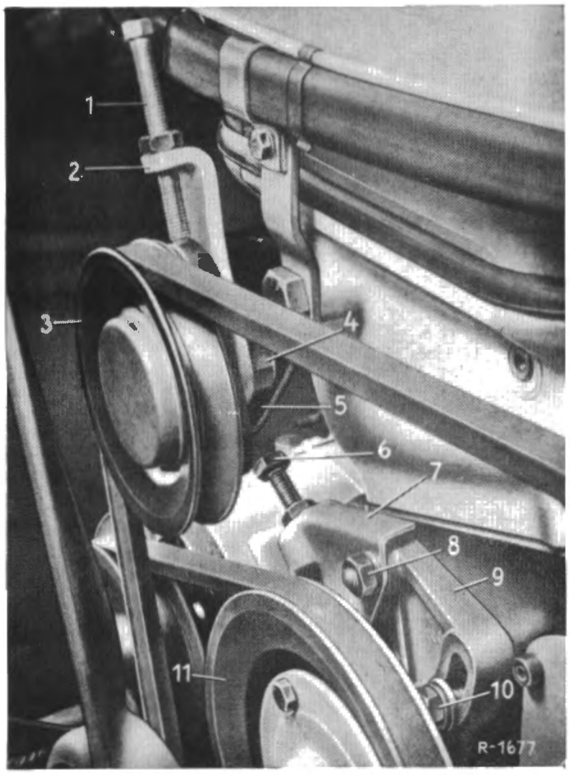


Fig. 32-12/9

1 Hexagon screw (tensioning screw) with lock nut
2 Tension bracket
3 V-belt pulley
4 Hexagon nut with lock washer
5 Bracket
6 Hexagon screw (tensioning screw) with lock nut
7 Retaining plate
8 Hexagon nut with lock washer
9 Fan bearing bracket
10 Hexagon nut with lock washer and washer
11 V-belt pulley for fan drive

2. **After 300 miles (Schedule A), 1900 miles (Schedule B), and Every 1900 miles (Schedules C, D and E)** drain condensation from the air reservoir. To do this, pull the drain valve (2) until there is no longer any condensation (approx. 2 sec.) (Fig. 32-12/10).

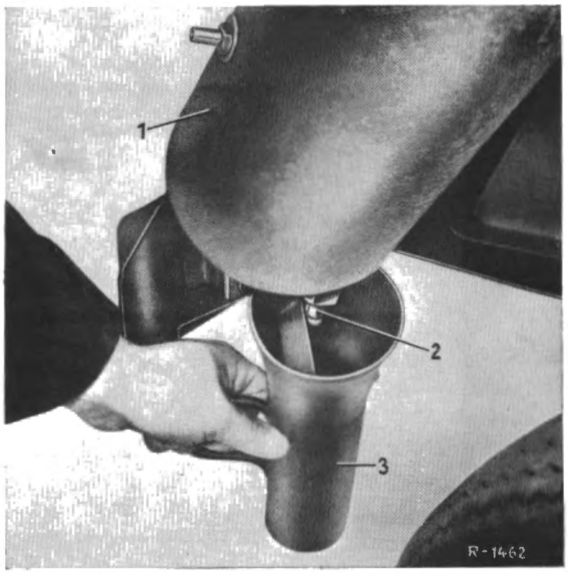


Fig. 32-12/10

1 Air reservoir
2 Drain valve
3 Container

3. **Every 12 000 miles (Schedule E)** check whether the hexagon socket screws for fastening the bracket (31) for the air compressor to the engine crankcase are firmly seated (Fig. 32-12/11).

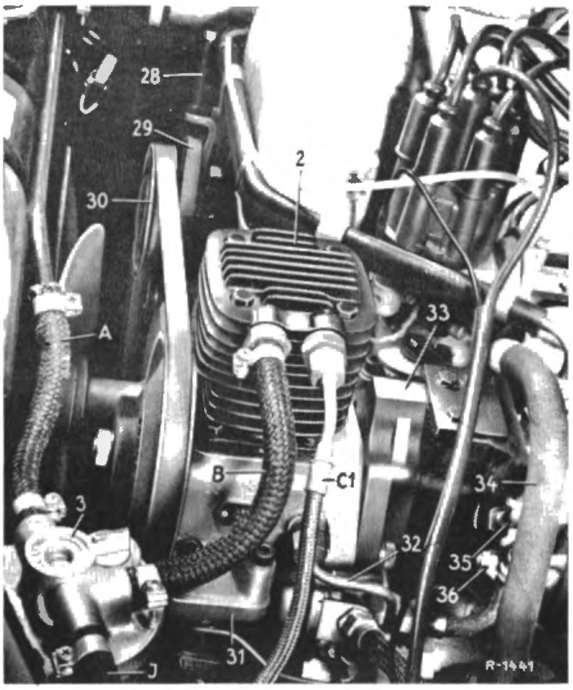


Fig. 32-12/11

A Intake and exhaust line from air intake silencer to vaporizer jar
B Intake line from vaporizer jar to air compressor
C1 Pressure line from air compressor to air reservoir
J Exhaust line from valve unit to vaporizer jar

2 Air compressor
3 Vaporizer jar
28 Tensioning screw
29 Support
30 Tension sprocket
31 Bracket for air compressor
32 Pressure oil line for lubrication of air compressor
33 High-pressure oil pump for power steering
34 Intake line
35 Pressure line
36 Strut

4. **After 1900 miles (Schedule B) and every 1900 miles (Schedules C, D and E),** during the winter season, when temperatures are below 5° C, fill the jar with 96 per cent. completely methylated ethyl alcohol (ethanol) up to the longitudinal groove. To do this, unscrew the screw plug (3b) (Fig. 32-12/12). Drain the condensation before filling up.

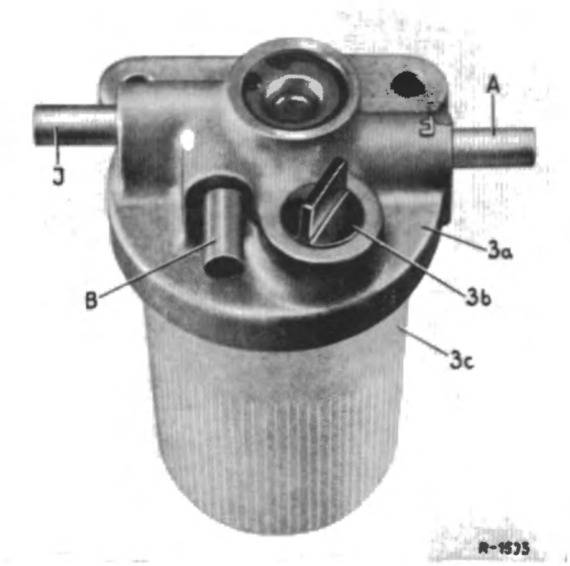


Fig. 32-12/12

A Connection for intake and exhaust line from air intake silencer to vaporizer jar
B Connection for intake line from vaporizer jar to air compressor
J Connection for exhaust line from valve unit to vaporizer jar

3a Valve body
3b Screw plug with rubber sealing ring
3c Jar

5. **Every 36 000 miles (Routine Service according to Schedule E),** check spring bellows for cracks. Hair cracks are of no importance. If larger cracks are found, replace the bellows (see Job No. 32-13).

Replace rear leveling valve (see Job No. 32-19).
Replace air cleaner on vaporizer jar.
Check the car level (see Job No. 40-5).

Trouble Shooting Hints for Air Suspension System

Job No.
32-13

Cause	Remedy
White Warning Lamp in Instrument Cluster Lights Up	
Push-pull button for valve unit pulled into position "Wheel Change".	Push button in **Note:** The white warning lamp in the instrument cluster also lights up when the hand brake is pulled.
Electric pressure indicator in valve unit faulty.	Replace pressure indicator.
Pressure in air reservoir has dropped below minimum	Check pressure in air reservoir (see Job No. 32-12).
Pressure in Air Reservoir Too Low	
Car level remains unchanged	
Tension of V-belt for air compressor drive insufficient or V-belt broken	Correct tension of V-belt or replace V-belt. **Note:** The high-pressure oil pump for the power steering is flanged to the air compressor and is thus driven by the same V-belt. If the V-belt is loose or broken, this condition will be noticed at once because with the power steering out of action more effort will be required to turn the wheel.
Delivery of air compressor unsatisfactory.	Check delivery (see Job No. 32-15). If necessary, repair or replace air compressor.
Leaky pressure line between air compressor and non-return valve.	Replace pressure line.
Non-return valve does not work.	Check non-return valve an, if necessary, replace as an assembly (see Job No. 32-16).
Non-return valve not properly closing, since connecting bore in cylinder head of air compressor clogged (only on first version — see Job No. 32-15).	Clean connecting bore (see Job No. 32-15).
Leaky filler valve on air reservoir.	Check whether valve body and high-pressure valve insert are seated properly. If necessary, replace the filler valve as an assembly.
Leaky drain valve on air reservoir.	Check whether drain valve is seated properly and, if necessary, replace.
Valve unit leaks on electric indicator for warning lamp, on safety valve or on a screw plug.	Check whether electric indicator, the safety valve and screw plugs are properly seated, and, if necessary, replace rubber sealing ring.

Cause	Remedy
Pressure in Air Reservoir Too Low	
Car level remains unchanged	
Leaky pressure reducing valve or pressure retaining valve in valve unit.	Replace valve unit.
Leaky pressure line connection in system between air reservoir and leveling valves.	Check all connections of pressure lines and hoses for leaks.
Leaky leveling valve on intake side.	Check leveling valves for leaks (see Job No. 32-19).
Car Level Too Low, Front or Rear	
Serious leak in pressure system to the bellows so that the working pressure is constantly below minimum.	Remove leak.
Leaky leveling valve.	Check leveling valves for leaks in the car (see Job No. 32-19).
Leaky connection between leveling valve and air chamber.	Check all connections.
Leaky air chamber or bellows.	Check air chamber and bellows for leaks (see Job No. 32-12). If necessary, unscrew bellows from air chamber and examine for cracks (see Job No. 32-14).
Car Level Too Low In Front	
Pressure reducing valve of valve unit not properly adjusted or leaky.	Check adjustment of pressure reducing valve (see Job No. 32-18).

Air Chamber with Bellows

Job No.
32-14

Removal and Installation of Air Chamber and Bellows, Disassembly, Reassembly and Leak Test

A. Removal and Installation of Air Chamber and Bellows, on Front Axle

Removal:

1. Jack up the car.
   Leave the push-pull button on the instrument panel in "Drive Position".

2. Exhaust the compressed air from the air reservoir.

3. Detach the connecting rod (10) for the leveling valve from the lower control arm; (Fig. 32-14/1). To do this, unscrew the ball pin.

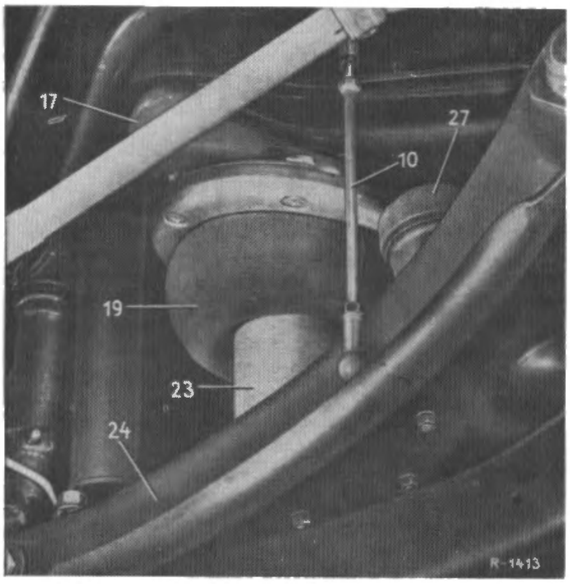


Fig. 32-14/1

10 Connecting rod for leveling valve
17 Air chamber
19 Bellows
23 Spring piston
24 Lower control arm
27 Rubber buffer

4. Detach the line (E_1) from the air chamber (Fig. 32-14/2).

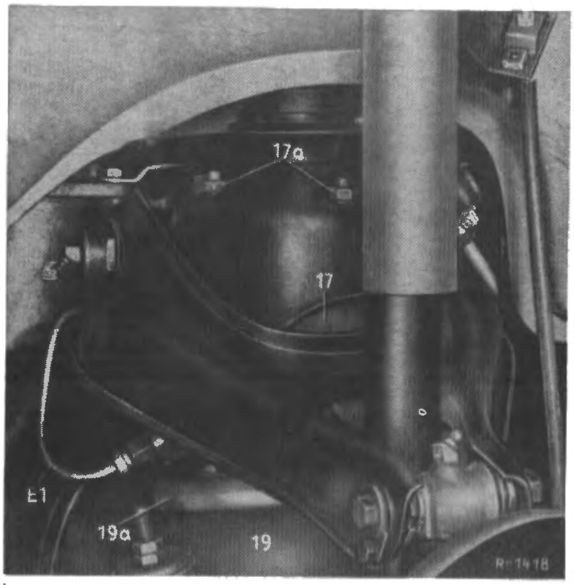


Fig. 32-14/2

E1 Connecting line from leveling valve to air chamber
17 Air chamber
17a Threaded pin for attaching the air chamber to the front axle support
19 Bellows
19a Clamping ring

5. Detach the bellows from the spring piston by means of a hammer handle (Fig. 32-14/3).

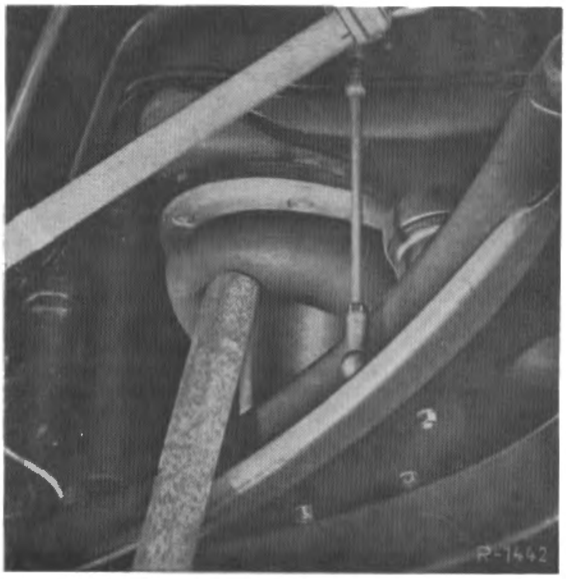


Fig. 32-14/3

6. Detach the tie-rod from the steering knuckle arm (Job No. 46-9).

7. Unscrew the spring piston from the lower control arm and remove (Fig. 32-14/4).

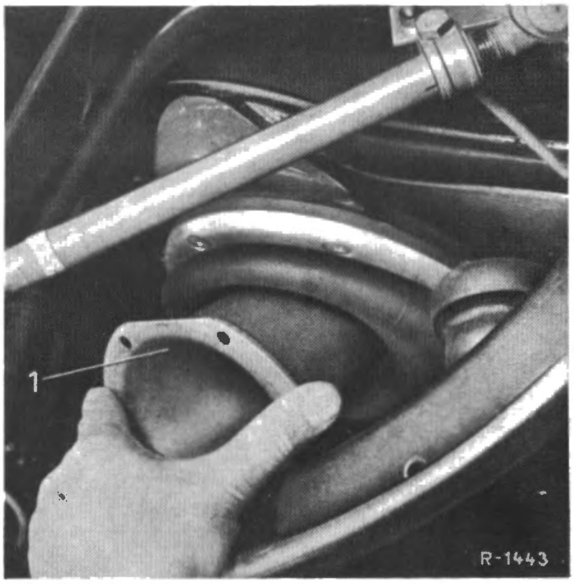


Fig. 32-14/4

Spring piston

8. Unscrew the three hexagon nuts for fastening the air chamber to the front axle support and remove air chamber with bellows (Fig. 32-14/5).

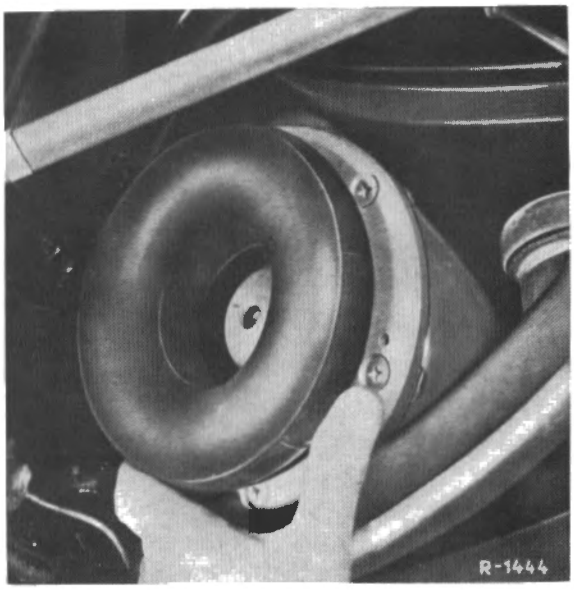


Fig. 32-14/5

Installation:

9. Insert air chamber and bellows and attach them to the front axle support. Coat the upper end of the spring piston with glyc-

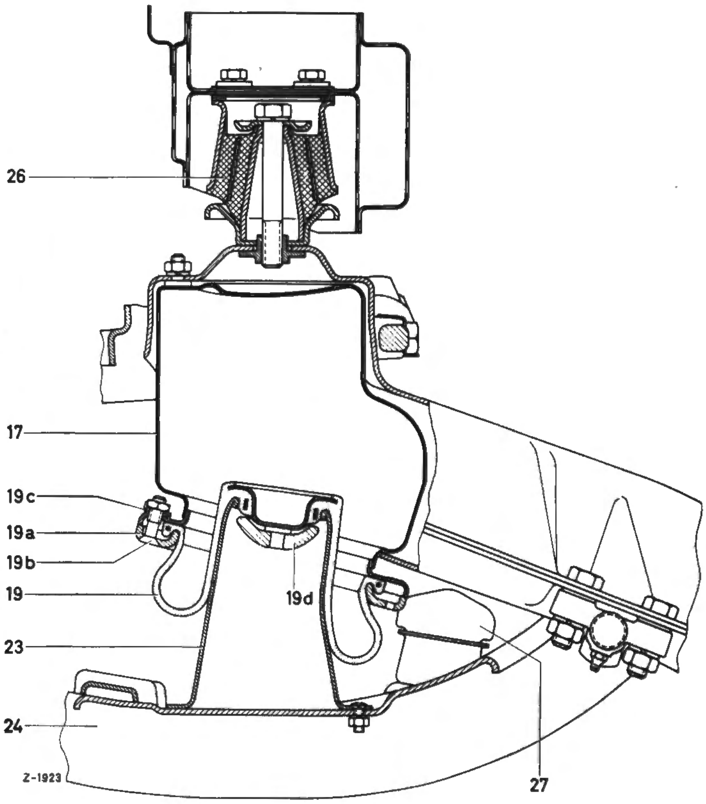


Fig. 32-14/6

Air chamber with bellows on front axle

17 Air chamber
19 Bellows
19a Clamping ring
19b Phillips head countersunk screw with hexagon nut and locking plate
19c Reinforcement plate
19d Centering piece on bellows
23 Spring piston
24 Lower control arm
26 Rubber mounting for suspension of front axle
27 Rubber buffer

erin, insert it and screw it to the lower control arm. (Fig. 32-14/6).

Note: Install the spring piston in such a way that the two faces of the attaching flange tally with the recess in the control arm.

10. Attach the line to the air chamber.

11. Attach the ball pin of the connecting rod for the leveling valve to the control arm.

12. Jack down the car.

Caution! Car has only little ground clearance.

13. Check the car level and, if necessary, correct (see Job No. 40-5).

B. Removal and Installation of Air Chamber and Bellows on rear axle

Removal:

1. Jack up the car.
   Leave the push-pull button on the instrument panel in ‚Drive Position'.
2. Exhaust compressed air from reservoir.
3. Detach the connecting rod (10) for the leveling valve from the lever of the torsion bar (see Fig. 32-19/2). To do this, unscrew the ball pin.

Fig. 32-14/7

6 Air chamber
9 Bellows
23 Spring piston
25 Torque arm
27 Rubber buffer

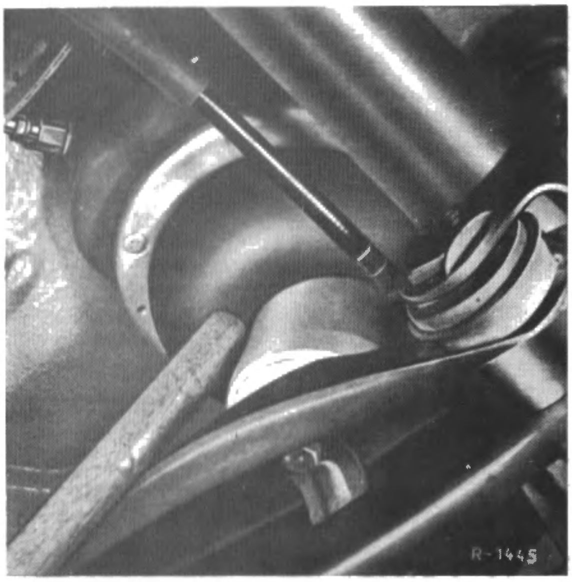


Fig. 32-14/8

4. Disconnect the lines (two on the left, one on the right) from the air chamber (Fig. 32-14/7).
5. Detach the bellows from the spring piston by means of a hammer handle (Fig. 32-14/8).

Fig. 32-14/9

1 Spring piston

6. Unscrew the spring piston (1) from the torque arm and remove (Fig. 32-14/9).
7. Unscrew the three hexagon nuts for fastening the air chamber to the chassis base panel and remove air chamber and bellows (Fig. 32-14/10).

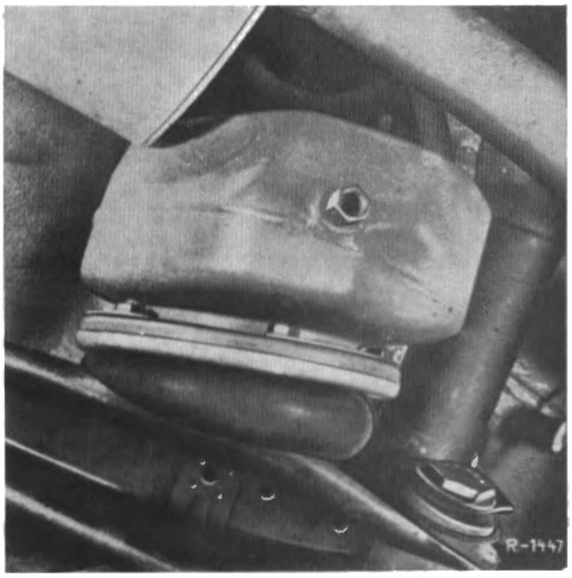


Fig. 32-14/10

NOTE: The two front hexagon nuts are accessible from the interior of the car after the rear seat has been removed, and the rear hexagon nut is accessible from the trunk.

Installation:

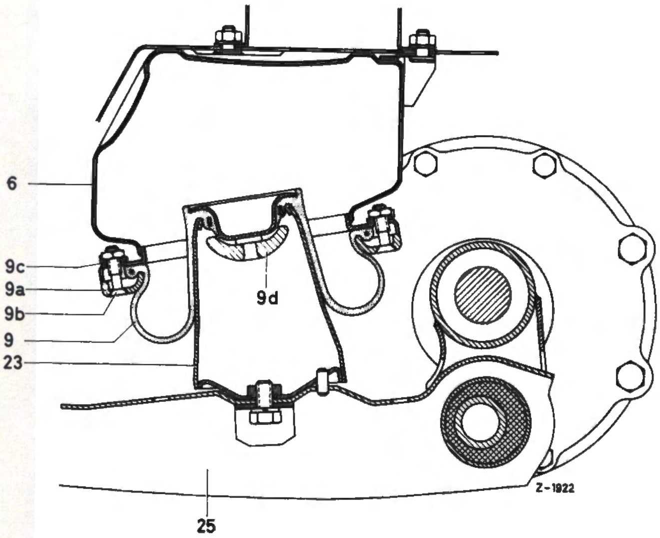


Fig. 32-14/11

Air chamber with bellows on rear axle

6 Air chamber
9 Bellows
9a Clamping ring
9b Phillips head countersunk screw with hexagon nut and locking plate
9c Reinforcement plate
9d Centering piece on bellows
23 Spring piston
25 Torque arm

8. Attach the air chamber to the chassis base panel. Coat the top end of the spring piston with glycerin, insert and screw to the torque arm (Fig. 32-14/11).

Note: The spring piston is fixed in position on the torque arm with a dowel pin (Fig. 32-14/11). Left and right spring piston are different.

9. Connect the lines to the air chamber.

10. Fix the lever of the leveling valve on the rear axle in its neutral position.

11. Fill up the system with compressed air (see Job No. 32-12).

12. Fill the rear bellows (see Job No. 32-12).

13. Jack down the car.

Caution! The car has only little ground clearance.

14. Check the car level and, if necessary, correct (see Job No. 40-5).

C. Disassembly and Reassembly of Air Chamber with Bellows, Leak Test

Disassembly:

1. Put the air chamber on a mounting plate held in a vise (Fig. 32-14/12).

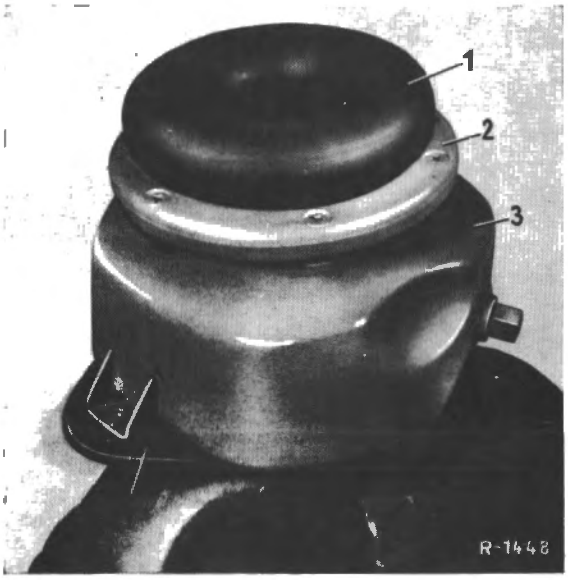


Fig. 32-14/12

1 Bellows
2 Clamping ring
3 Air chamber
4 Mounting plate

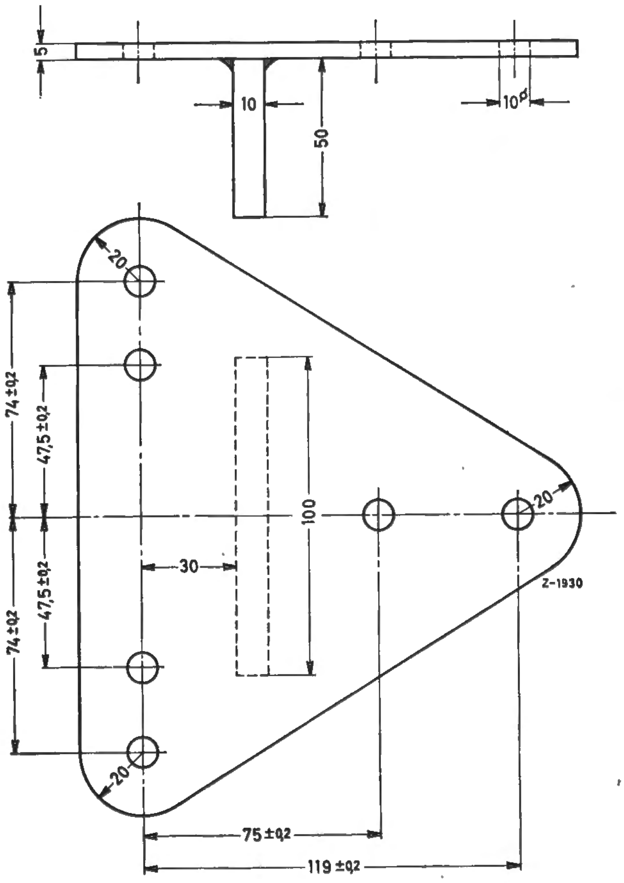


Fig. 32-14/13

Note: The mounting plate can be made in the workshop according to the details given in Fig. 32-14/13.

2. After unscrewing the Phillips head screws, detach the bellows from the air chamber (Fig. 32-14/14).

Fig. 32-14/14

1 Bellows   2 Clamping ring   3 Air chamber

Reassembly:

3. Mount new bellows in accordance with installation instructions (Fig. 32-14/15). See also Figs. 32-14/6 and 11.

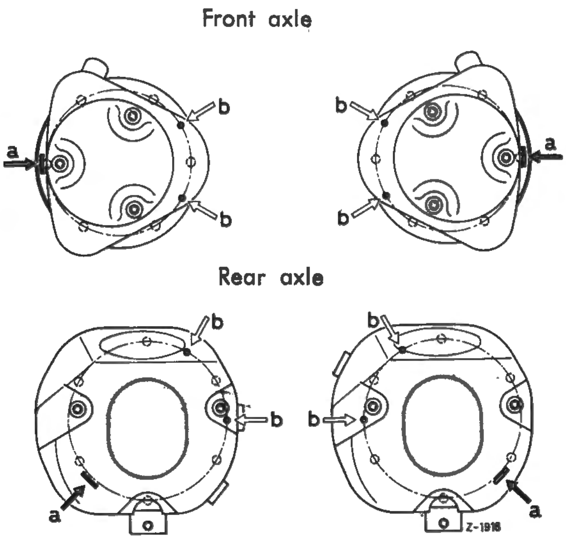


Fig. 32-14/15

a Location of trademark on bellows
b Location of water drain holes in clamping ring

Prescribed Position of Trademark on bellows and Position of Clamping Ring.

The clamping ring for the bellows should always be installed in such a way that the two water drain holes are opposite the trademark on the bellows, that is, always at the lowest point.

Leak Test for Air Chamber and Bellows:

4. Connect the air chamber to a stationary compressed-air installation and fill to prescribed testing pressure (see Job No. 32-0).

5. Check air chamber and bellows for leaks under water (Fig. 32-14/16).

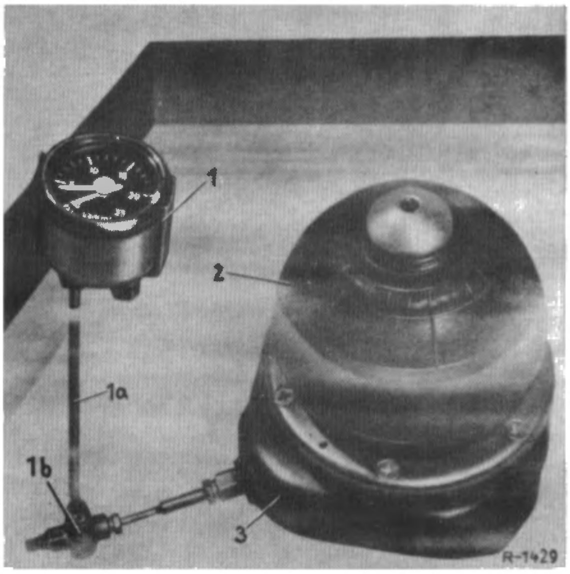


Fig. 32-14/16

1 Pressure gage
1a Connecting line
1b Connecting fitting with filler valve
2 Bellows
3 Air chamber

Air Compressor

Job No.
32-15

Removal and Installation of Air Compressor, Performance Test, Replacement of Valves

Removal:

1. Disconnect hose lines (B) and (C 1) and the pressure oil line (32) from the air compressor (Fig. 32-15/1).

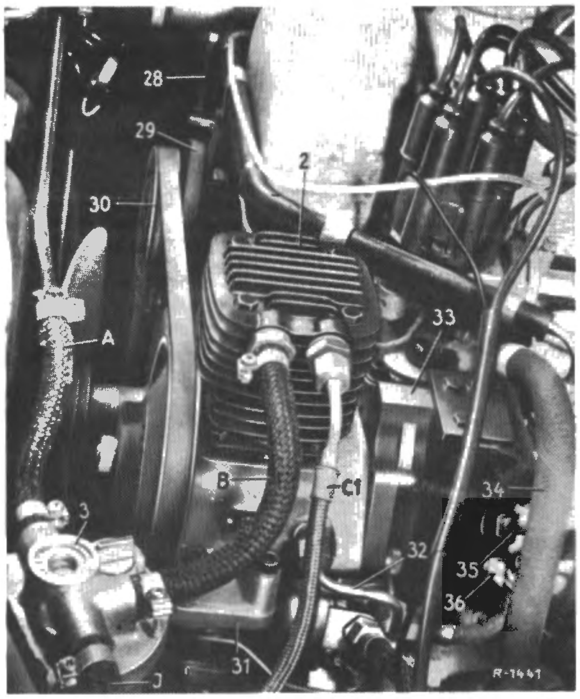


Fig. 32-15/1

A Intake and exhaust line from air intake silencer to vaporizer jar
B Intake line from vaporizer jar to air compressor
C1 Pressure line from air compressor to air reservoir
J Exhaust line from valve unit to vaporizer jar

2 Air compressor
3 Vaporizer jar
28 Tensioning screw
29 Support
30 Tension sprocket
31 Bracket for air compressor
32 Pressure oil line for lubrication of air compressor
33 High-pressure oil pump for power steering system
34 Intake line
35 Pressure line
36 Strut

2. Loosen the V-belt for the air compressor drive by turning out the tensioning screw (28) (Fig. 32-15/1).

3. Disconnect the hose lines (34) and (35) directly from the high-pressure oil pump (33) for the power steering. Unscrew the air compressor from the bearing bracket (31) and the strut (36) and remove together with high-pressure oil pump (Figs. 32-15/1 and 2).

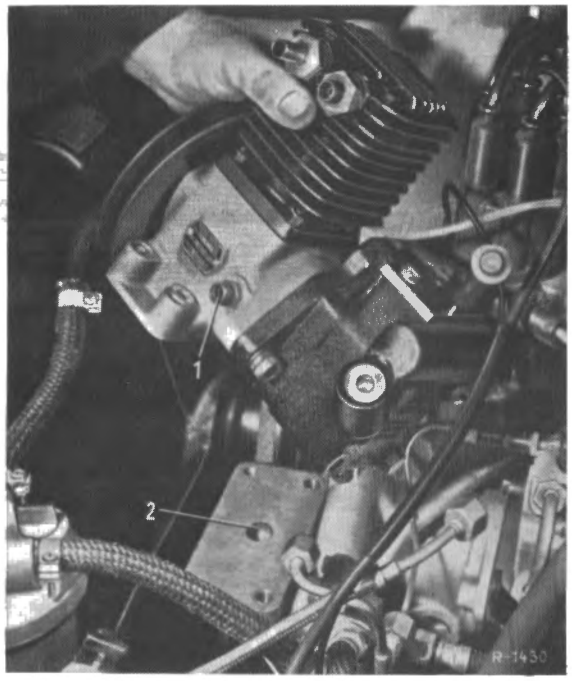


Fig. 32-15/2

1 Connection for pressure oil line
2 Oil return bore

4. Remove high-pressure oil pump from air compressor.

Installation:

5. Attach the high-pressure oil pump for the power steering to the air compressor (see Job No. 46-26).

6. Attach the air compressor to the bearing bracket making sure that the rubber sealing ring for the oil return is properly seated.

7. Install the V-belt and tension as specified (see Job No. 32-12, Section B).

8. Connect the lines.

Performance Test:

Note: Performance has to be checked when the specified working pressure is no longer reached.

9. Connect a suitable pressure gage (1) to the filler valve (2) of the air reservoir (Fig. 32-15/3).

10. Reduce the pressure to 12 atm at the drain valve (4) of the air reservoir. Then run the engine at a speed of approx. 2,000 rpm. Measure the time required to raise the reservoir pressure from 12 atm to 14 atm (for values see Job. No. 32-0).

Fig. 32-15/3

1 Pressure gage
1a Connecting hose
1b Connecting fitting
2 Filler valve
3 Air reservoir
4 Drain valve

Replacement of Valves:

11. Disconnect the intake and pressure line from the cylinderhead. Loosen hexagon screws. Remove cylinder head and valve plate (8) (Fig. 32-15/4).

12. Check segment valves (11) and (12) and, if necessary, replace. Check and clean valve seats in the valve plate (8).

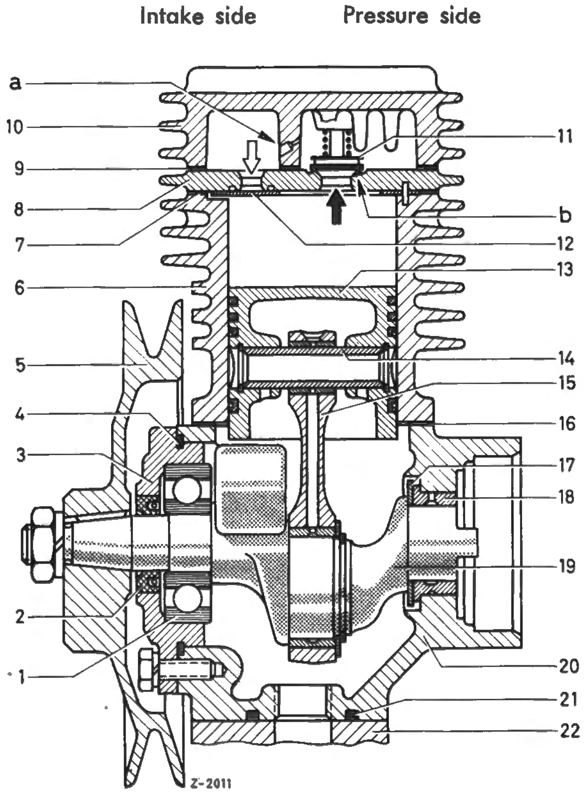


Fig. 32-15/4

Section of air compressor

a = Connecting bore on 1st version air compressor
b = Notch in valve seat on 2nd version air compressor

1 Annular grooved bearing
2 Sealing ring
3 Bearing cap
4 Rubber sealing ring
5 V-belt pulley
6 Cylinder
7 Gasket
8 Valve plate
9 Gasket
10 Cylinder head
11 Segment valve (pressure side)
12 Segment valve (intake side)
13 Piston
14 Piston pin
15 Connecting rod
16 Gasket
17 Spacer washer
18 Bearing bushing
19 Crankshaft
20 Crankcase
21 Rubber sealing ring
22 Bracket for air compressor

Note: In order to guarantee complete closing of the non-return valve in the air reservoir when the engine is not running, the air must be able to flow out of the pressure line between air compressor and air reservoir. On the 1st version air compressor this is achieved by the connecting bore "a" of 0.3 mm diameter between pressure and intake chamber in the cylinder head, on the 2nd version by the notch "b" in the seat for the segment valve (11) on the pressure side (Fig. 32-15/4). The air then escapes into the atmosphere via the piston rings.

If the bore "a" is clogged, the pressure in the pressure line will prevent the valve cone of the non-return valve in the air reservoir from being pressed firmly against its seat so that air can escape slowly from the air reservoir through the segment valve (11) on the pressure side.

A clogged bore should be cleaned with a 0.3 mm drill.

Proper functioning of the non-return valve and the connecting bore is checked by detaching the intake line of the air compressor at the vaporizer jar and holding it in a water vessel. If air escapes steadily, the non-return valve does not close completely. The cause may be either a clogged bore or a non-return valve that does not close properly. Before removing the cylinder head always check the non-return valve itself for leaks (see Job No. 32-16).

Air Reservoir

Job No.
32-16

Removal and Installation of Air Reservoir, Leak Test

Removal:

1. Pull push-pull button on instrument panel into 'Wheel Change' position.
2. Jack the car up at the front and remove the left front wheel.
3. Completely evacuate the air reservoir.
4. Disconnect both hose lines. Unscrew hexagon screws at the top (13a) and hexagon nut at the bottom (13b) (Fig. 32-16/1).
5. Remove air reservoir.

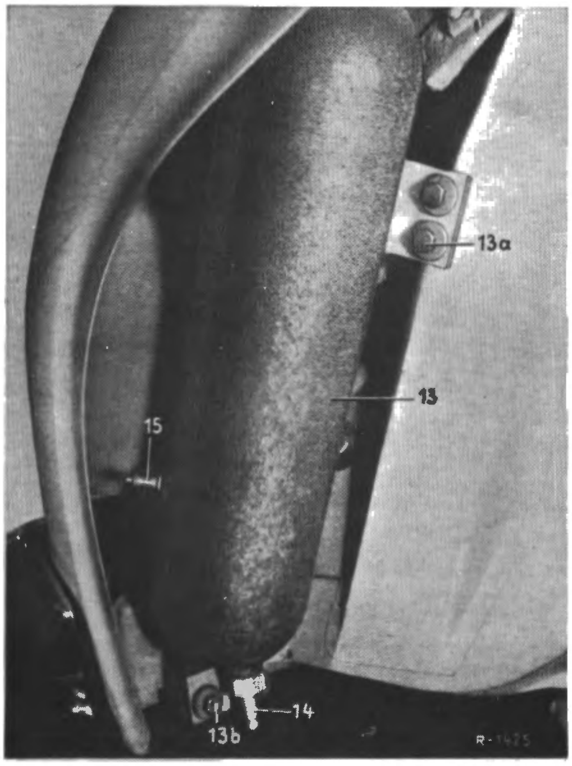


Fig. 32-16/1

13 Air reservoir
13a Upper attachment
13b Lower attachment
14 Drain valve
15 Filler valve

Leak Test:

6. Check whether the non-return valve, the filler valve, the drain valve and the screw plug (5) are firmly seated (Fig. 32-16/2). For non-return valve tightening torque see Job No. 32-0.
7. Fill the air reservoir at the filler valve to the prescribed test pressure (see Job No. 32-0) and check for leaks under water (Fig. 32-16/2).

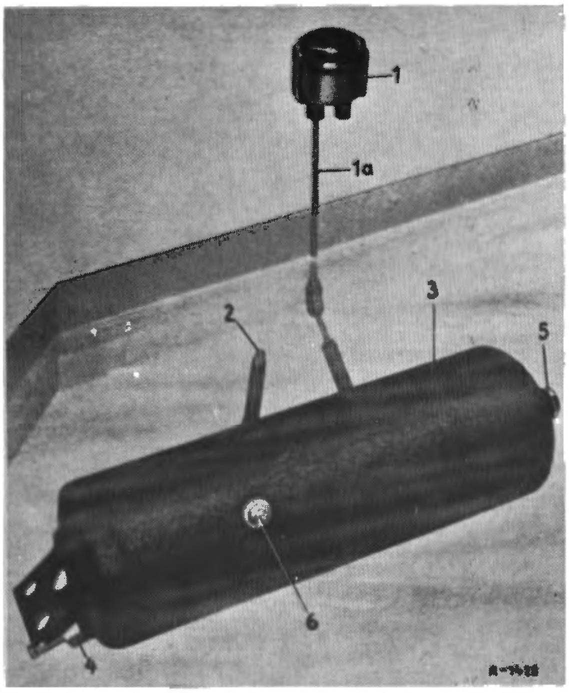


Fig. 32-16/2

1 Pressure gage
1a Connecting line
2 Non-return valve
3 Air reservoir
4 Drain valve
5 Screw plug
6 Filler valve

Note: a) If the non-return valve has a leak at the valve cone, replace the valve as an assembly.

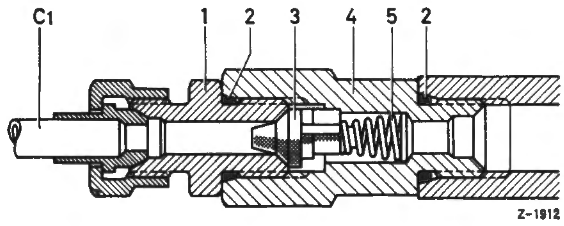


Fig. 32-16/3

Non-return valve

C1 Pressure line from air compressor to air reservoir
1 Valve cap
2 Rubber sealing ring
3 Valve cone
4 Valve body
5 Valve spring

In order to check the non-return valve when the air reservoir is installed in the vehicle, disconnect the pressure line (C 1) from the air compressor and immerse the hose line in a water jar.

b) In principle the filler valve of the air suspension system is the same as a tube filler valve, with the difference that the screwed-in insert takes the form of a high-pressure insert. As a replacement only the complete filler valve assembly can be supplied.

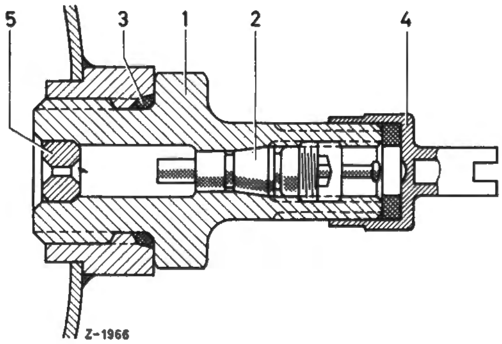


Fig. 32-16/4

Filler valve

1 Valve body
2 High-pressure insert
3 Rubber sealing ring
4 Dust cap with rubber sealing ring
5 Throttle jet

c) After removing the snap ring on the valve body (1) the drain valve can be disassembled. If the rubber sealing ring in the valve plate (3) is damaged, the drain valve should be replaced as an assembly (Fig. 32-16/5).

Installation:

8. Attach the air reservoir to cowl making sure that the attachment parts are in their proper position (Fig. 32-16/6).

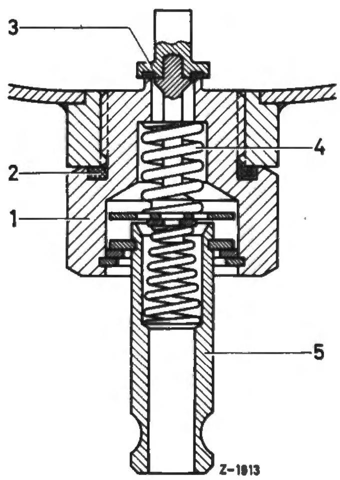
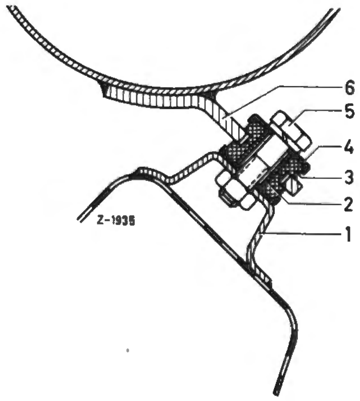


Fig. 32-16/5

Drain valve

1 Valve body
2 Rubber sealing ring
3 Valve plate
4 Valve spring
5 Discharge tube

Upper attachment



Lower attachment

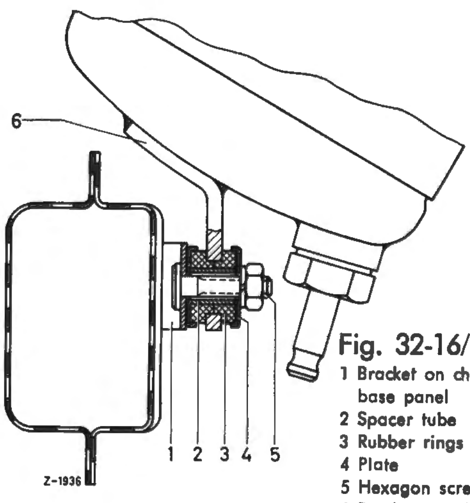


Fig. 32-16/6

1 Bracket on chassis base panel
2 Spacer tube
3 Rubber rings
4 Plate
5 Hexagon screw
6 Bracket on air reservoir

9. Connect the two hose lines to the non-return valve and the outlet connection.

10. Fill the system with compressed air (see Job No. 32-12).

11. Install the left front wheel and jack the car down.

Vaporizer Jar

Job No.
32-17

Removal and Installation, Disassembly and Reassembly of Vaporizer Jar

Removal:

1. Disconnect all three hose lines.
2. Unscrew hexagon screws and remove vaporizer jar from the cowl (Fig. 32-17/1).

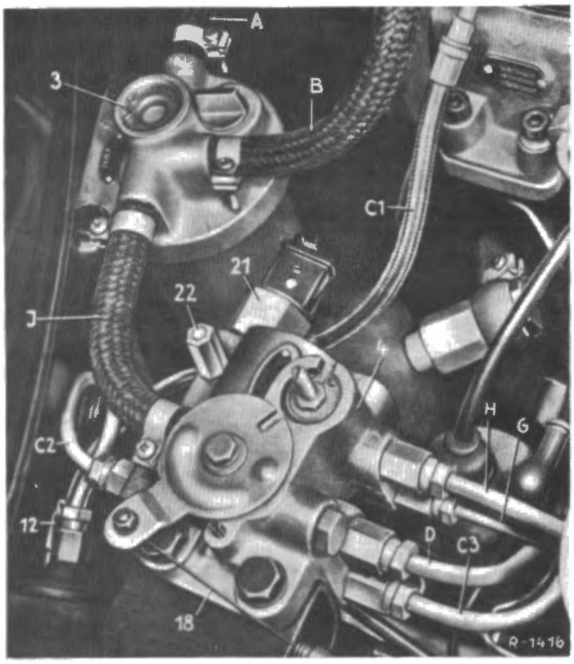


Fig. 32-17/1

A Intake and exhaust line from air intake silencer to vaporizer jar
B Intake line from vaporizer jar to air compressor
C1 Pressure line from air compressor to air reservoir
C2 Pressure line from air reservoir to valve unit
C3 Pressure line (full working pressure) from valve unit to rear leveling valve
D Pressure line (reduced working pressure) from valve unit to front leveling valves
G Exhaust line from front leveling valves to valve unit
H Exhaust line from rear leveling valve to valve unit
J Exhaust line from valve unit to vaporizer jar
3 Vaporizer jar
4 Valve unit
12 Non-return valve
18 Cable for valve unit
21 Electric pressure indicator for warning lamp
22 Safety valve

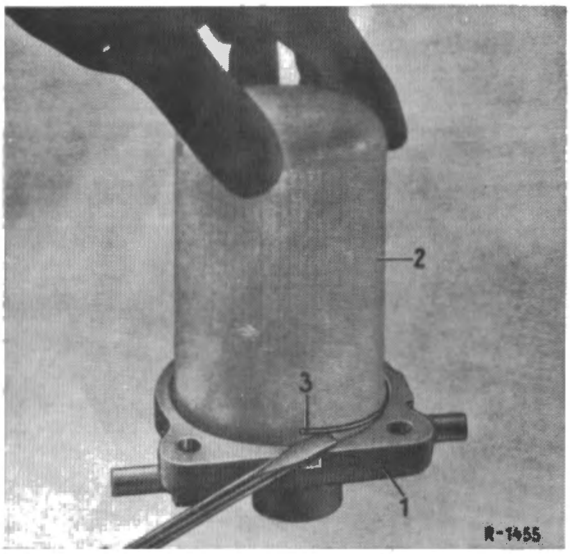


Fig. 32-17/2

1 Valve body
2 Jar
3 Snap ring

Disassembly:

3. If necessary, press out the snap ring (3) and remove the jar (2) (Figs. 32-17/2 and 3).

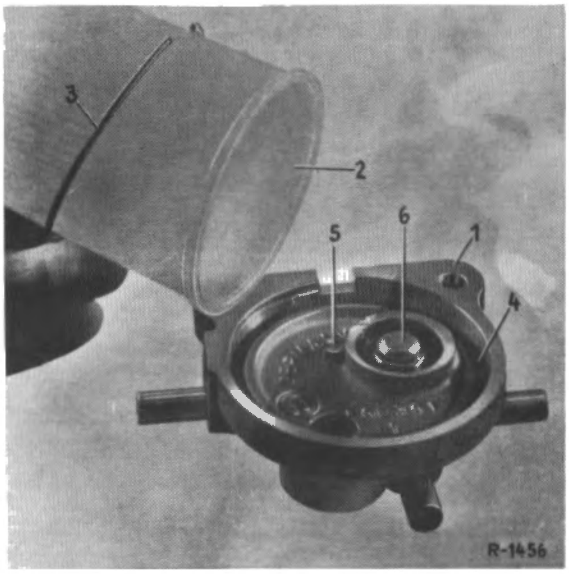


Fig. 32-17/3

1 Valve body
2 Jar
3 Snap ring
4 Rubber sealing ring
5 Jet in intake valve
6 Blow-off valve

Reassembly:

4. Check whether the jet (5) in the valve body is fully serviceable (Fig. 32-17/3).

5. Install the jar, making sure that the rubber sealing ring (4) and the snap ring (3) are properly seated.

Installation:

6. Attach the vaporizer jar to the cowl and connect the hose lines.

7. During the winter season fill the jar with 96 per cent. ethyl alcohol (ethanol) (see Job No. 32-12, Section B).

Valve Unit

Job No. 32-18

Removal and Installation of Valve Unit, Valve Adjustment Check

Removal:

1. Completely evacuate the air reservoir.

2. Pull out the plug on the electric indicator (21) for the warning lamp (Fig. 32-18/1).

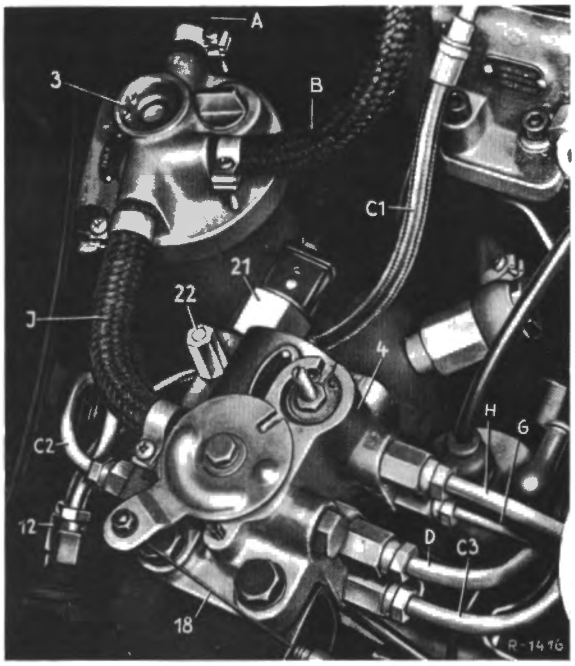


Fig. 32-18/1

A Intake and exhaust line from air intake silencer to vaporizer jar
B Intake line from vaporizer jar to air compressor
C1 Pressure line from air compressor to air reservoir
C2 Pressure line from air reservoir to valve unit
C3 Pressure line (full working pressure) from valve unit to rear leveling valve
D Pressure line (reduced working pressure) from valve unit to front leveling valves
G Exhaust line from front leveling valves to valve unit
H Exhaust line from rear leveling valve to valve unit
J Exhaust line from valve unit to vaporizer jar

3 Vaporizer jar
4 Valve unit
12 Non-return valve
18 Cable for valve unit
21 Electric pressure indicator for warning lamp
22 Safety valve

3. Disconnect the lines and hose lines as well as the Bowden cable (18) (Fig. 32-18/1).

4. Detach the valve unit from the cowl and remove.

Installation:

5. Attach the valve unit to the cowl and connect the lines.

Note: It is advisable to install the cap nuts of the lines before the hexagon screws are tightened.
The various connections are marked on the valve unit body (Fig. 32-18/2).

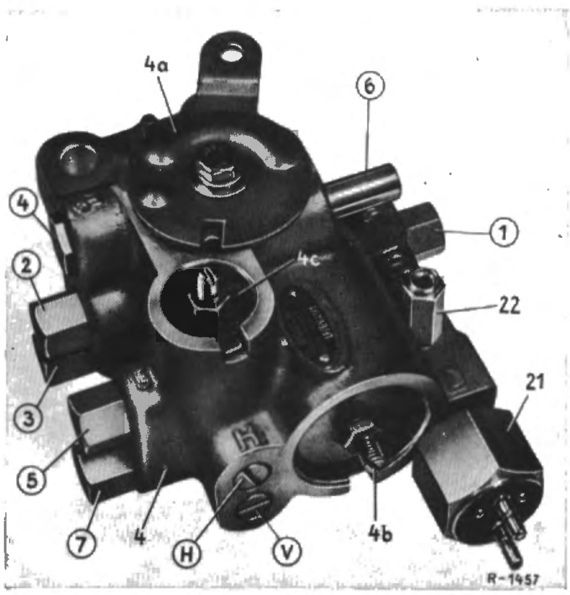


Fig. 32-18/2

(1) Compressed air from air reservoir
(2) Compressed air to front leveling valves
(3) Compressed air to rear leveling valve
(4) Closed
(5) Exhaust air from leveling valve
(6) Exhaust air to vaporizer jar
(7) Exhaust air from front leveling valves
(D) Connection for electric pressure indicator for warning lamp
(V) Screw plug for exhaust air from front axle
(H) Screw plug for exhaust air from rear axle

4 Valve unit
4a Lever
4b Pressure reducing valve
4c Pressure retaining valve
21 Electric pressure indicator for warning lamp
22 Safey valve

7. Connect the cable for the valve unit to the lever (1a). To do this, push the push-pull button on the instrument panel in completely and secure the lever on the valve unit by means of a 5 mm ⌀ pin in "Drive Position" (Fig. 32-18/3).

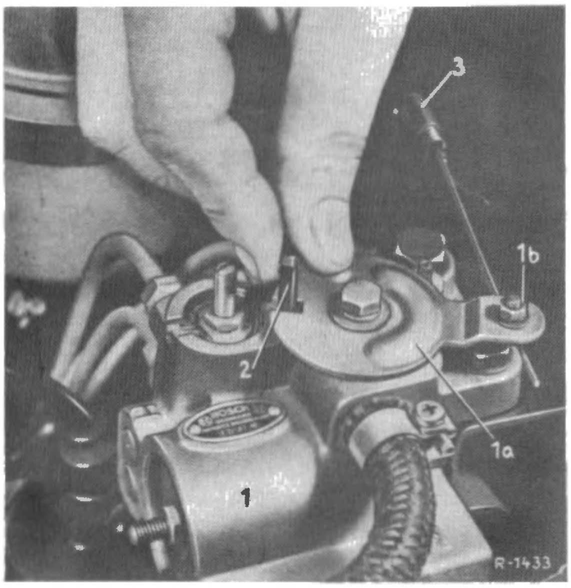


Fig. 32-18/3

1 Valve unit
1a Lever
1b Clamping screw
2 Fixing pin
3 Cable for valve unit

8. Fill the system with compressed air (see Job No. 32-12).

Valve Adjustment Check:

9. On the valve unit connect a pressure gage with twin indicators to the connections (2) (pressure line to front axle) and (7) (exhaust line from front axle) (Fig. 32-18/4).

10. In order to check the correct adjustment of the pressure reducing valve (4b) (Fig. 32-18/2) depress the car at the front in order to put the leveling valves on the front axle in the position "Air Intake". In this position the pressure in the pressure line to the front leveling valves must correspond to the values given in Job No. 32-0.

11. In order to check the correct adjustment of the pressure retaining valve (4c) (Fig. 32-18/2), lift the car at the front in order to get the leveling valves on the front axle in the position "Air Exhaust". In this position the pressure in the exhaust line from the leveling valves to the valve unit must correspond to the values given in Job No. 32-0.

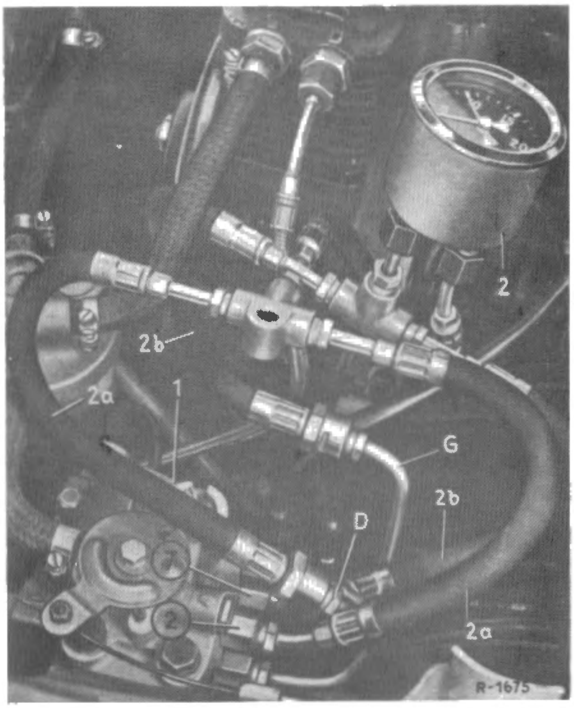


Fig. 32-18/4

(2) Connection for compressed air to front leveling valves
(7) Connection for exhaust air from front leveling valves
D Pressure line (reduced working pressure) from valve unit to front leveling valves
G Exhaust line from front leveling valves to valve unit

1 Valve unit
2 Pressure gage with twin indicators
2a Connection line to pressure gage for compressed air
2b Connection line to pressure gage for exhaust air

12. If necessary, adjust the filling pressure on the pressure reducing valve (4b) and the blow-off pressure on the pressure retaining valve (4c) (Fig. 32-18/2). The pressure is increased by turning the adjusting screw in, and it is decreased by turning the adjusting screw out.

Note: During these checking operations the minimum pressure in the air reservoir should be 12 atm.

Leveling Valves

Job No.
32-19

Removal and Installation of Leveling Valves, Leak Test

Removal:

1. Jack the car up.
   Leave the push-pull button on the instrument panel in **"Drive Position"**.

2. Completely evacuate the air reservoir.

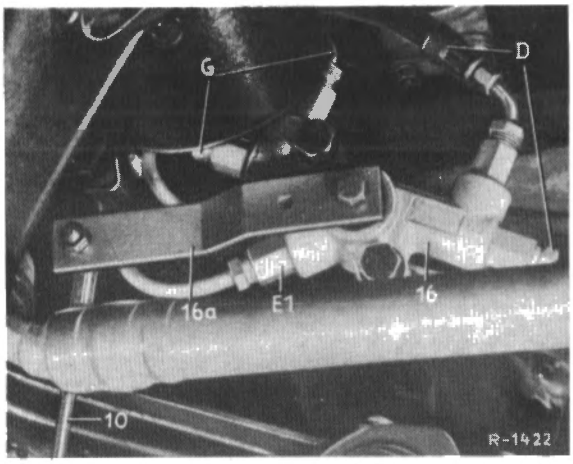


Fig. 32-19/1

Leveling valve on front axle, left

D Pressure line (reduced working pressure) from valve unit to front leveling valves
E1 Connecting line from front leveling valve to air chamber
G Exhaust line from front leveling valve to valve unit

10 Connecting rod
16 Front leveling valve, left
16a Lever

3. Detach the connecting rod (10) of the leveling valve. To do this, unscrew the ball pin from the lever (Fig. 32-19/1 and 2).

4. Disconnect the lines at the leveling valve. Unscrew the leveling valve from the bracket and remove (Figs. 32-19/1 and 2).

Installation:

5. Screw on the leveling valve and connect the lines.

Note: The connections at the leveling valve are marked as follows:

(E) = Filling line
(B) = Connecting line to bellows
(A) = Exhaust line

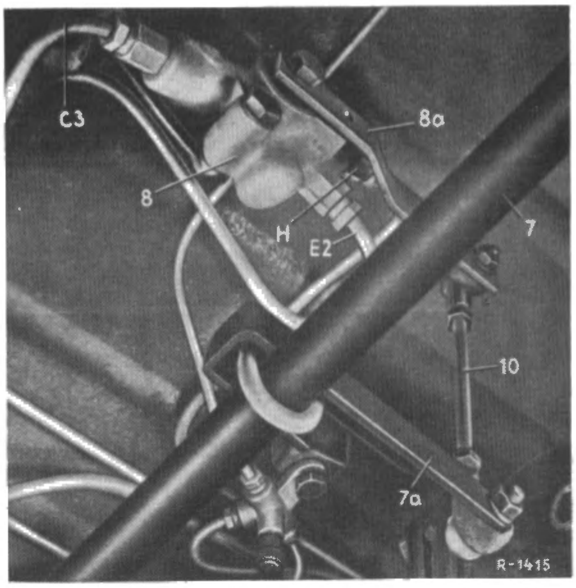


Fig. 32-19/2

Leveling valve on rear axle

C3 Pressure line (full working pressure) from valve unit to rear leveling valve
E2 Connecting line from rear leveling valve to air chamber
H Exhaust line from rear leveling valve to valve unit

7 Torsion bar on rear axle
7a Lever on torsion bar
8 Rear leveling valve
8a Lever

6. Jack the car down.

Caution! Car has only very little ground clearance.

7. Fill the system with compressed air (see Job No. 32-12).

8. Check the car level (see Job No. 40-5).

Leak Test:

Minimum pressure in air reservoir 12 atm.

9. Disconnect the exhaust line (3) from the valve unit to the vaporizer jar at connection (1a) (Fig. 32-19/3).

10. Connect the hose (4) of the water jar (5) to the valve unit. With the car in a stationary position no air should escape via the exhaust line. If air escapes nevertheless, this is a sign that there is a leak in one of the leveling valves (Fig. 32-19/3).

11. In order to determine which one of the leveling valves has a leak, disconnect the exhaust line (2) (Connection A) at the valves and instead connect the hose (3) of the water jar (4) (Fig. 32-19/4).

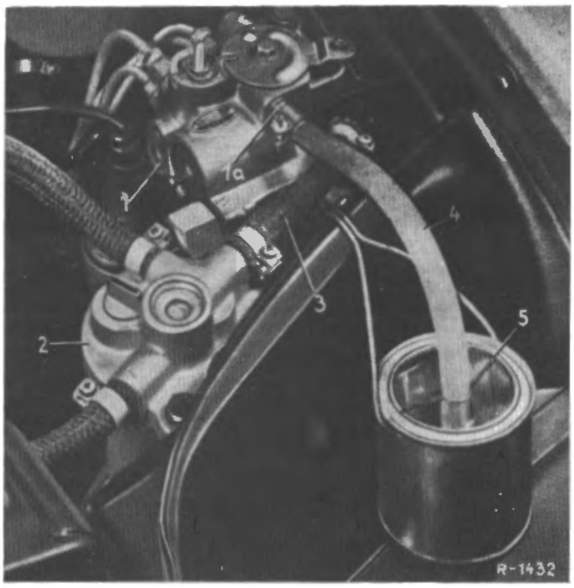


Fig. 32-19/3

1 Valve unit
1a Connection for exhaust line
2 Vaporizer jar
3 Exhaust line
4 Hose
5 Water jar

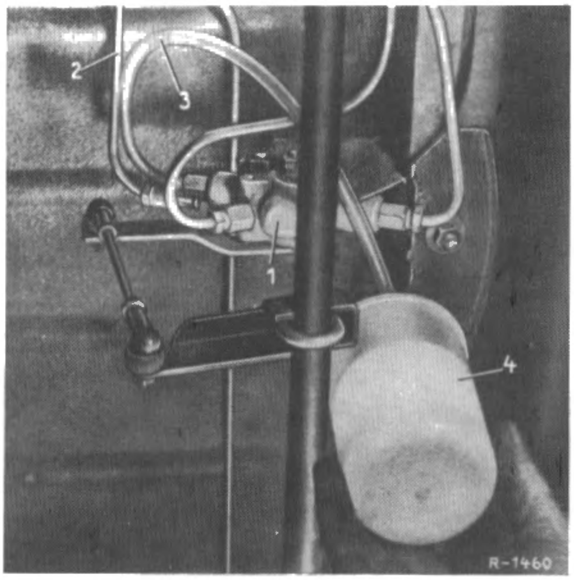


Fig. 32-19/4

1 Leveling valve
2 Exhaust line from leveling valve to valve unit (Connection A)
3 Hose to water jar
4 Water jar

Job No.

Job No.
33-0

Front Axle

General Data, Dimensions and Tolerances

*Modifications marked**

Front Axle, First Version

Models 220, 220 Sb, 220 SEb Sedan

Rubber Mounting							Associated flat spring	
Part No.	External Diameter mm	Internal Diameter mm	Width mm	Collar Width mm	Rubber hardness °Shore	Remarks	Length "a" (Fig. 33-0/8) mm	Metal thickness
000 988 30 10	36.2 / 36.1	18.000 / 18.110	35±0.1	3.5±0.1	40±5	with vulcanized spacer tube (earlier version)	298±0.5¹)	2.5
110 322 06 85	36.3 / 36.1	22.0 / 22.1	34.5±0.3		55±5	without vulcanized spacer tube (subsequent version)		

¹) Together with replacement front axle support part no. 111 330 34 42 install flat springs 286 mm long, part no. 111 331 12 12.

Front Axle, Second Version

Model	Version	Rubber Mounting							Associated flat spring	
		Part No.	External Diameter mm	Internal Diameter mm	Width mm	Collar Width mm	Eccentricity "a" of bore (Fig. 33-0/7) mm	Rubber hardness °Shore	Length "a" (Fig. 33-0/8) mm	Metal thickness mm
190 c 190 Dc 220 b 220 Sb 220 SEb Sedan	—	110 322 15 85					1.5		248±0.5²)	
220 SEb/C	1st¹)	112 322 00 85					7		243±0.5	
	2nd	110 322 15 85	45.6 / 45.4	20.0 / 20.1	27±0.2	3.5±0.1	1.5	55±5		2.5
230 SL	—								248±0.5	
220 b 220 Sb 220 SEb with power steering	—	112 322 03 85					4.5		243±0.5	
300 SE	—									

¹) Was installed only on Model 220 SEb Coupé.
*²) In special cases, if the prescribed caster adjusting values cannot be obtained with a 248 mm flat springs, it is permissible to install 243 mm springs. It goes without saying that the left and right flat springs must be of equal length when repairs are being carried out on the cha ssis base panel assembly.

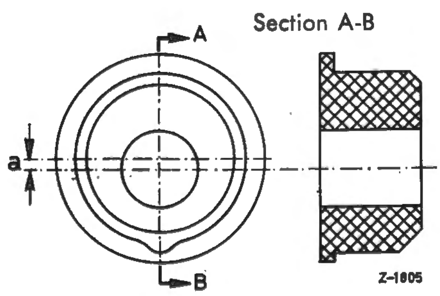


Fig. 33-0/7
Rubber Mounting

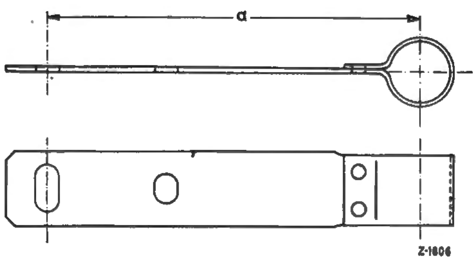


Fig. 33-0/8
Flat Spring

Grease Reserve of Front Wheel Hub

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL

Anti-friction bearing grease		
Total capacity[1]) g	Hub with bearings[2]) g	Hub cap[3]) g
65—80	45—55	20—25

Note: Use the Specified Amounts, Neither More nor Less!

[1]) It is advisable to weigh the total amount before reassembling the front wheel hub.

[2]) The races of the annular taper roller bearing should be well filled with anti-friction bearing grease. Apply grease also to the front faces of the rollers.

[3]) Fill up approximately to the flared rim.

Wheel Bearing Play

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL

End play of front wheel hub (adjustable by clamping nut on steering knuckle)	0.01—0.02 mm (measured with Tester 136 589 04 21 and dial gage)[1])

[1]) When the wheel bearing play is properly adjusted, the ground washer located between the outer annular taper roller bearing and the clamping nut can just be turned by hand. However, this method should only be used as an additional check because the wheel bearing play should always be adjusted with a dial gage.

Tightening Torques

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL

<table>
<tr><th>Front axle version</th><th colspan="4">Fastening attachment</th><th>Thread</th><th>Tightening torque approx. mkg</th></tr>
<tr><td rowspan="3">1st and 2nd</td><td colspan="4">Hexagon screws for fastening the upper control arm to the front axle support</td><td rowspan="3">M 12×1.5</td><td>10</td></tr>
<tr><td colspan="3" rowspan="2">Hexagon screws for fastening the lower control arm to the front axle support[1])</td><td>8 G screws</td><td>10</td></tr>
<tr><td>10 K screws</td><td>13</td></tr>
<tr><td rowspan="3">1st</td><td rowspan="8">Flat spring for front axle longitudinal support[2])</td><td rowspan="5">Fastening to chassis base panel</td><td colspan="2" rowspan="2">Hexagon screws</td><td>M 12×1.5</td><td>10</td></tr>
<tr><td>M 14×1.5</td><td>14</td></tr>
<tr><td colspan="2">Hexagon nut for the eccentric bolt</td><td>M 12×1.5</td><td>10</td></tr>
<tr><td rowspan="2">2nd</td><td colspan="2">Hexagon nut for the square screw</td><td rowspan="2">M 14×1.5</td><td rowspan="2">14</td></tr>
<tr><td colspan="2">Hexagon nut for the eccentric bolt</td></tr>
<tr><td>1st</td><td rowspan="3">Fastening to front axle support</td><td colspan="2">Bolt</td><td>M 18×1.5</td><td>15</td></tr>
<tr><td>2nd</td><td colspan="2">Hexagon screw</td><td>M 16×1.5</td><td>12*</td></tr>
<tr><td>1st and 2nd</td><td colspan="2">Hexagon screws (clamping screws) for the rubber mounting</td><td>M 8</td><td>2.5</td></tr>
<tr><td>2nd</td><td colspan="4">Hexagon screw for fastening the rubber mounting to the front axle support (see Fig. 33-1/17)</td><td>M 12×1.5</td><td>10</td></tr>
<tr><td>1st and 2nd</td><td colspan="4">Threaded bushings in control arm</td><td>M 30×2 or M 31×2*</td><td>18</td></tr>
<tr><td>*1st and 2nd</td><td colspan="4">Hexagon nut for fastening the steering knuckle support to the king pin</td><td>M 14×1.5</td><td>9</td></tr>
</table>

[1]) On recent models quality 8 G screws and quality 5 S nuts have been replaced by special 10 K screws (Part No. 111 990 07 01) together with 8 G nuts (Part No. 000 990 16 51). When repairs are being carried out, only these screws and nuts should be used.

[2]) For 1st version front axle see Fig. 33-1/8, for 2nd version front axle see Fig. 33-1/19.

Removal and Installation of Front Axle Support together with Front Axle Halves

Job No.
33-1

Modification: 2nd Version Front Axle (Addition)

A. 1st Version Front Axle

Removal:

1. Jack up the car at the front, remove the front wheels and the brake drums.

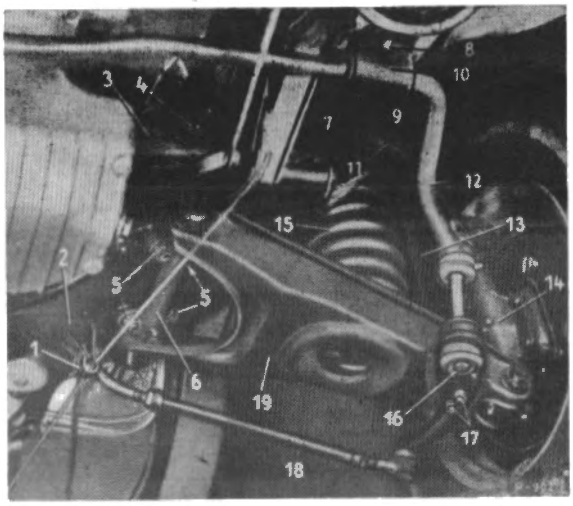


Fig. 33-1/1

1 Cable guide at front axle support
2 Front axle support
3 Engine support
4 Hexagon screw and spring washer
5 Hexagon screws with nuts and lock washers for fastening the pivot pin to the front axle support
6 Pivot pin for lower control arm
7 Flat spring supporting the front axle support
8 Hexagon screw (M 12×1.5×25) with lock washer
9 Hexagon screw (M 14×1.5×25) with lock washer
10 Rubber mounting for torsion bar
11 Upper control arm
12 Torsion bar
13 Front shock-absorber
14 Steering knuckle
15 Front spring
16 Hexagon screw for fastening the torsion bar to the lower control arm
17 Hexagon nuts with lock washers for fastening the lower shock-absorber suspension
18 Tie-rod
19 Lower control arm

2. Remove the front shock-absorbers (see Job-No. 32-2).

3. Remove the torsion bar (see Job-No. 32-6).

4. Remove the front springs (see Job No. 32-4). Thereafter reattach the lower control arms provisionally to the front axle support.

5. Screw off the wing nut (1) for adjusting the hand-brake at the hand-brake lever (3). Remove the cotter pin (5) which secures the center brake cable (7) at the lower part of the lever and pull the brake cable through the guide on the front axle support (Fig. 33-1/2).

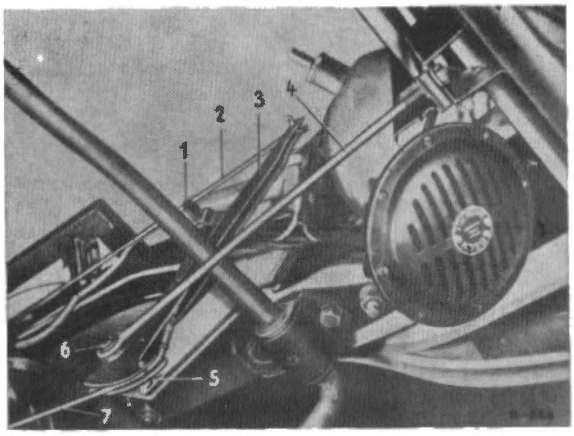


Fig. 33-1/2

1 Wing nut
2 Front brake cable
3 Hand-brake lever
4 Supporting rod
5 Cotter pin
6 Pivot pin
7 Center brake cable

6. Unscrew the hexagon nut (7) on the two flat springs (8) for the longitudinal support of the front axle right and left and knock out the bolt (2) (Fig. 33-1/3).

Note: When removing the front axle support it is not necessary to loosen the hexagon nut (15) at the eccentric bolt (14). However, if it proves difficult to knock out the bolt (2) mark the position of the flat spring on the chassis base panel and unscrew the hexagon nut at the eccentric bolt. In such cases the flat spring remains attached to the front axle support when the latter is removed (Fig. 33-1/3).

7. Disconnect the brake hose from the brake line left and right at the chassis base panel (Fig. 33-1/9).

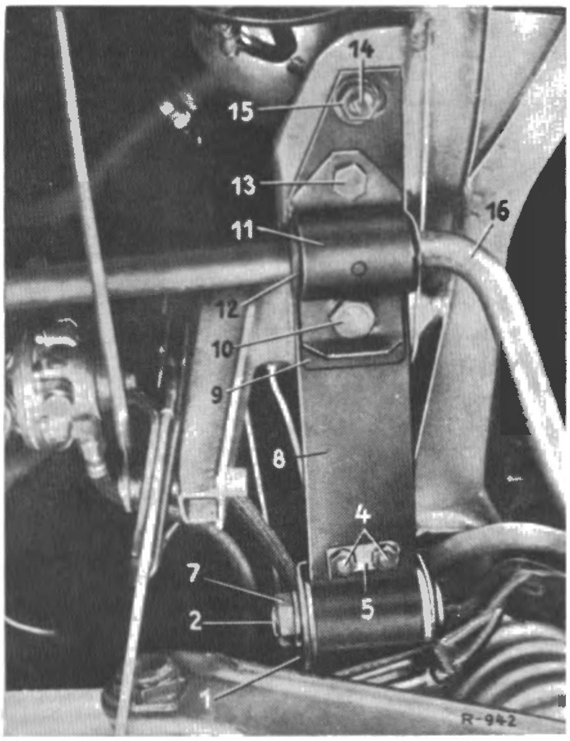


Fig. 33-1/3

1 Bearing bracket at front axle support
2 Bolt
4 Hexagon screws (clamping screws)
5 Locking plate
7 Hexagon nut
8 Flat spring
9 Locking plate for rubber mounting
10 Hexagon screw (M 14×1.5×25) with lock washer
11 Bracket for rubber mounting
12 Rubber mounting for torsion bar
13 Hexagon screw (M 12×1.5×25) with lock washer
14 Eccentric bolt
15 Hexagon nut with lock washer and washer
16 Torsion bar

8. Detach the tie-rods right and left from the steering knuckle arm (see Job No. 46-9/).

9. Remove the battery and on cars with carburetor engines remove the air intake silencer.

10. Place Supporting Bracket 111 589 03 31 (1) for the engine on the right and left of the wheel arch panel. Then suspend the engine by the water pump and raise it slightly Fig. 33-1/4).

11. Unscrew the two hexagon screws (4) by which the engine support (3) is fastened to the rubber mountings of the front engine suspension (Fig. 33-1/1).

12. Place the jack with Fixture 111 589 02 63 under the front axle support (Fig. 33-1/7).

13. Unscrew right and left the hexagon screws (2) for fastening the rubber mountings for the suspension of the front axle support to the chassis base panel (Fig. 33-1/5).

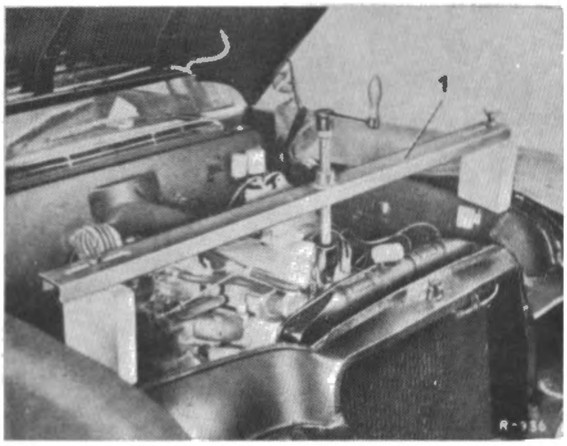


Fig. 33-1/4

1 Supporting Bracket 111 589 03 31 for the engine

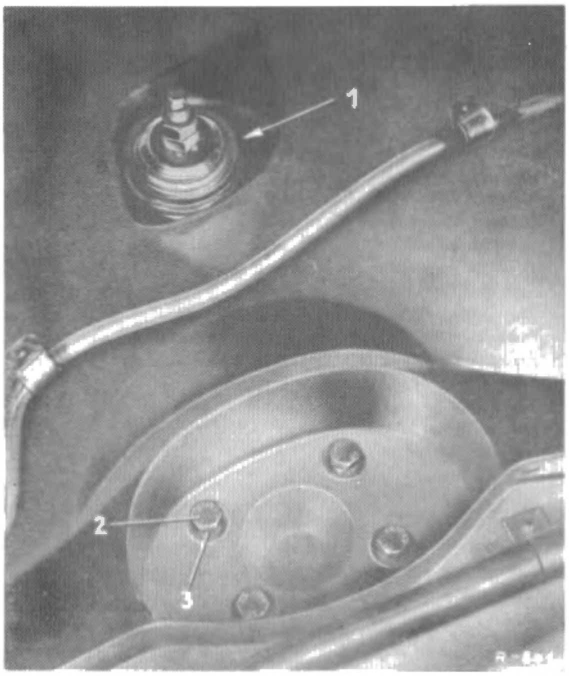


Fig. 33-1/5

1 Upper shock-absorber suspension
2 Hexagon screws with lock washers
3 Washers

14. Jack down the car and remove the front axle support with the front axle halves.

15. Check the rubber mountings (3) of the flat springs (8) supporting the front axle support and replace them if necessary (see Job No. 33-3). Do not yet tighten the hexagon screws (clamping screws) (Fig. 33-1/8).

16. Check the two rubber mountings (4) for the front axle support. If necessary, replace the rubber mountings. For this purpose remove the four hexagon screws (5) left and right from the threaded ring (6) (Fig. 33-1/6).

Note: The upper part of the rubber mounting has an eccentric position on the lower fixing cup. When installing the rubber mounting make sure that the wider part of the cup points outward (Fig. 33-1/6).

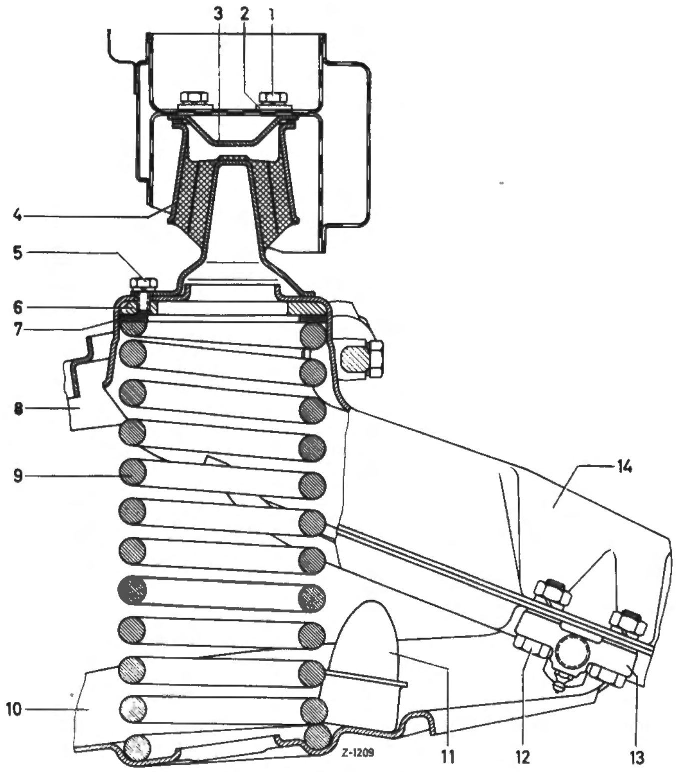


Fig. 33-1/6

1 Hexagon screws with lock washers for fastening the rubber mounting to the chassis base panel
2 Washer
3 Stop plate at chassis base panel
4 Rubber mounting for front axle support
5 Hexagon screws with lock washers for fastening the rubber mounting toe the front axle suppo.
6 Threaded ring
7 Rubber washer
8 Upper control arm
9 Front spring
10 Lower control arm
11 Rubber buffer
12 Hexagon screws (M 12×1.5) with nuts and lock washers
13 Pivot pin for lower control arm
14 Front axle support

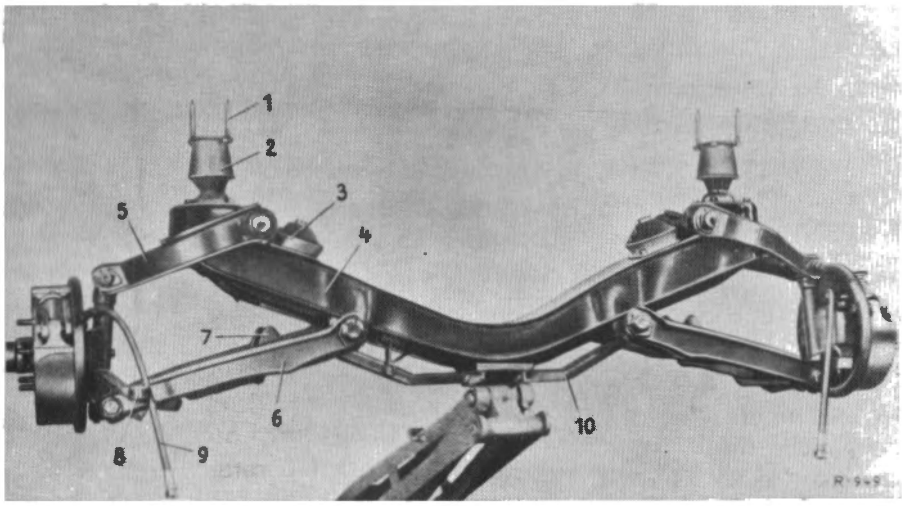


Fig. 33-1/7

1 Guide pin
2 Rubber mounting for front axle support
3 Rubber mounting of the front engine suspension
4 Front axle support
5 Upper control arm
6 Lower control arm
7 Rubber buffer
8 Steering knuckle
9 Brake hose
10 Fixture 111 589 02 63

17. Place the front axle support with the front axle halves in Fixture 111 589 02 63 on the jack and screw two guide pins (1) each crosswise into the rubber mountings (2) for the front axle support, at both right and left (Fig. 33-1/7).

18. Lift the front axle support inserting the flat springs (8) on the left and right into the bearing bracket (1) on the front axle support (Fig. 33-1/8).

19. Screw out the guide pins from the rubber mountings for the front axle support. Then screw in and tighten the four hexagon screws for fixing the rubber mountings right and left to the chassis base panel (Fig. 33-1/5).

20. Fit the bolts (2) for the flat springs for the longitudinal support of the front axle support at the left and at the right and tighten the hexagon nut (7) with the prescribed torque (Fig. 33-1/8).

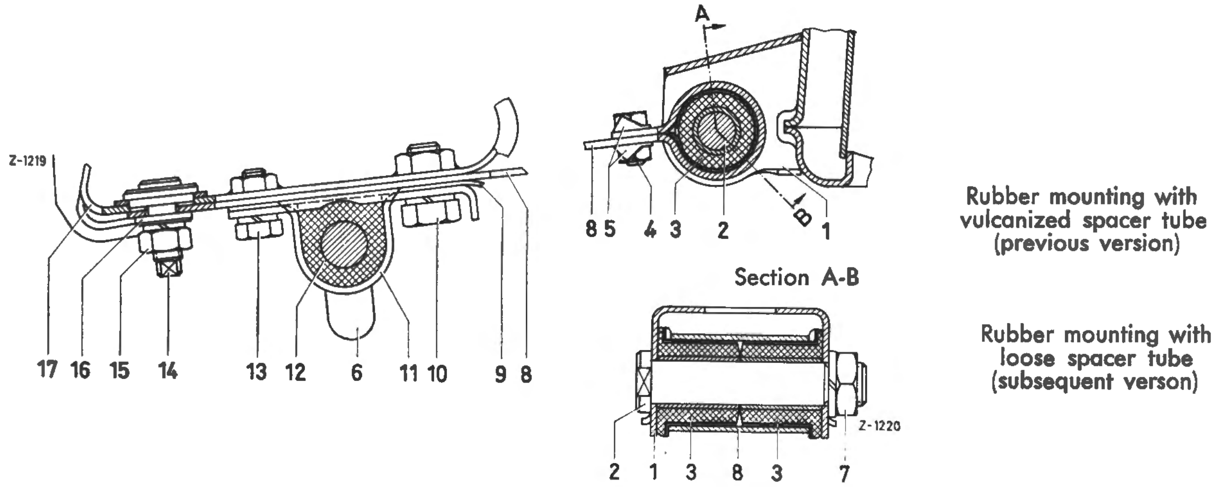


Fig. 33-1/8

1 Bearing bracket of front axle support
2 Bolt
3 Rubber mounting for flat spring
4 Hexagon screw with nut
5 Locking plate
6 Torsion bar
7 Hexagon nut with lock washer
8 Flat spring
9 Locking plate
10 Hexagon screw (M 14X1.5X25) with lock washer
11 Retainer for rubber mounting
12 Rubber mounting for torsion bar
13 Hexagon screw (M 12X1.5X25)
14 Eccentric bolt
15 Hexagon nut with lock washer with lock washer
16 Washer
17 Chassis base panel
18 Spacer ring
19 Spacer tube

Note: If the front axle support was removed together with the flat springs (8), fasten the flat springs left and right to the chassis base panel with the hexagon nut (15) for the eccentric bolt (14), noting the position marked during removal.

b) If the rubber mountings of the flat springs have been replaced, the hexagon screws (clamping screws) should be tightened with the prescribed torque. On recent cars the locking plates have been replaced by lock washers (Fig. 33-1/8).

21. Screw in and tighten the two hexagon screws (4) for fastening the engine support (3) to the rubber mountings of the front engine suspension. Then remove the supporting bracket for the engine (Fig. 31-1/1).

22. Install the front springs (see Job No. 32-4).

23. Install the torsion bar (see Job No. 32-6).

24. Install the front shock-absorbers (see Job No. 32-2).

25. Install the battery and on cars with carburetor engines install the air intake silencer.

26. Fit the tie-rods to the right and left of the steering knuckle arm (see Job No. 46-9).

27. Check the brake hoses (7) right and left and make sure that they fit tightly into the brake line on the brake anchor plate. Loosen the hexagon screw (5) on the retainer (1) and insert the brake hose in the protection plate (6) at the retainer (1). Take

care that the hose is not twisted. Now tighten the hexagon nut (5) on the retainer. Fit the brake hose retainer (2), screw the sleeve nut (4) of the brake line (3) into the brake hose and tighten, holding the brake hose steady (Fig. 33-1/9).

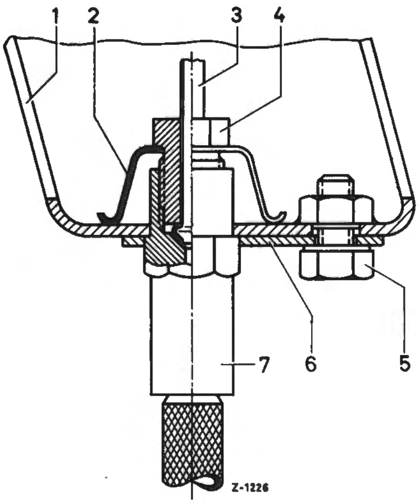


Fig. 33-1/9

1 Retainer at chassis base panel
2 Brake hose retainer
3 Brake line
4 Sleeve nut
5 Hexagon screw with spring washer
6 Protection plate
7 Brake hose

Note: In early models there is no protection plate for the brake hose retainer. When connecting up make quite sure that the brake hose is not twisted; otherwise there is a danger that the hose will rub against the upper control arm.

28. Bleed the brake system.

29. Pull the center brake cable (7) through the guide on the front axle support and fit it to the hand-brake lever (3). Fit the cotter pin (5) for securing the brake cable at the lower end of the lever (Fig. 33-1/2).
Adjust the hand-brake (see Job No. 42-20).

30. Fit the front wheels and the brake drums, jack down the car, and tighten up the wheel nuts.

31. Check the axle positioning distance, the camber, caster and toe-in of the front wheels, and if necessary adjust (see Job No. 40-3).

B. 2nd Version Front Axle

On cars with air suspension see "General Assembly Instructions" (Job No. 32-11).

Removal:

1. Jack up the car at the front, remove the front wheels and on cars with drum brakes remove the brake drums.

2. Remove the front shock absorber (see Job No. 32-2).

3. Remove the torsion bar (see Job No. 32-6).

Note: The flat springs for the longitudinal support of the front axle are attached to the chassis base panel together with the torsion bar mounting (Fig. 33-1/12). Before the hexagon nuts are slackened, the position of the flat springs should be marked on both sides by means of a scriber.

4. Remove the front springs (see Job No. 32-4). Then reattach the lower control arms provisionally to the front axle support.

5. Unscrew the wing nut (8) for the hand-brake adjustment underneath the tunnel (Fig. 33-1/11).

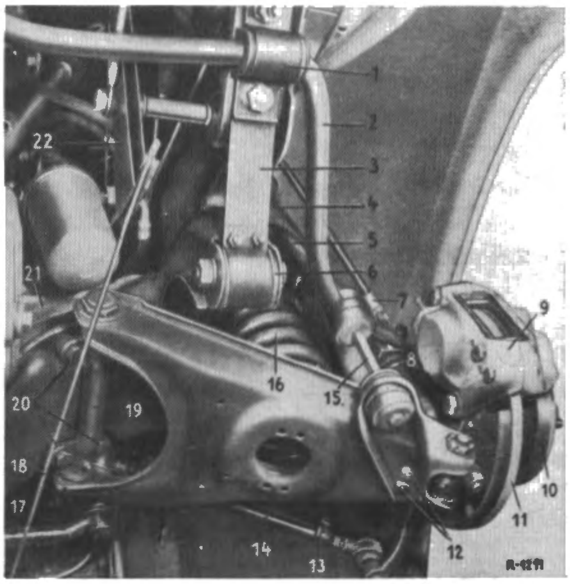


Fig. 33-1/10

1 Torsion bar and flat spring mounting on chassis base panel
2 Torsion bar
3 Flat spring
4 Shock absorber
5 Upper control arm
6 Flat spring mounting on front axle support
7 Brake hose
8 Steering knuckle
9 Brake caliper
10 Front wheel hub
11 Brake disk
12 Lower shock absorber suspension
13 Tie-rod
14 Lower control arm
15 Torsion bar mounting on lower control arm
16 Front spring
17 Center tie-rod
18 Center brake cable
19 Pivot pin
20 Hexagon screw for fastening the pivot pin for the lower control arm
21 Engine support
22 Hand-brake lever

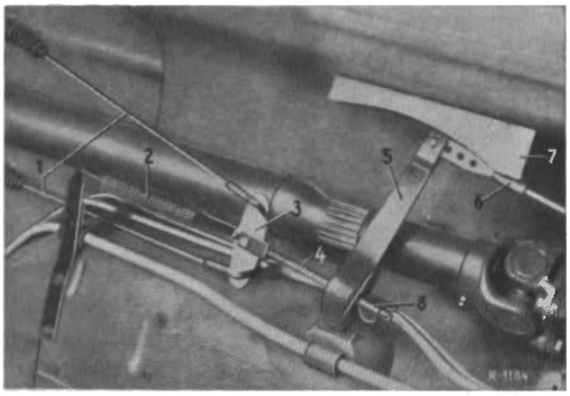


Fig. 33-1/11

1 Rear brake cables
2 Return spring
3 Equalizer
4 Tensioning screw
5 Relay lever
6 Center brake cable
7 Guide for equalizer
8 Wing nut for adjusting the hand brake

6. Remove the cotter pin (6) securing the center brake cable (5) to the lower part of the hand-brake lever and detach the brake cable (Fig. 33-1/12).

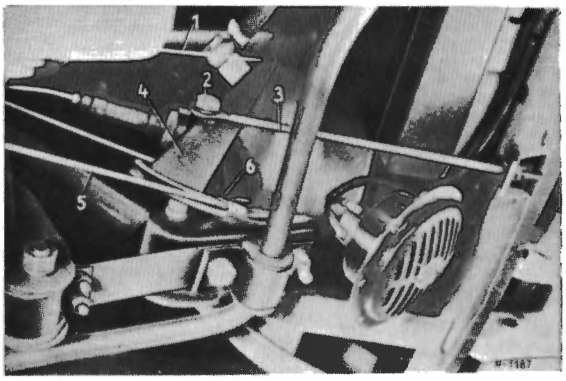


Fig. 33-1/12

1 Front brake cable
2 Hexagon screw with locking plate
3 Pull rod for supporting the hand-brake lever mounting
4 Hand-brake lever
5 Center brake cable
6 Cotter pin

7. Detach the brake hose from the brake line on the chassis base panel left and right (Fig. 33-1/20).

8. Loosen and tap out the hexagon screw (6) on the bearing bracket (5) for the two flat springs (2) for the front axle longitudinal support at the left and at the right (Fig. 33-1/13). Remove the flat spring from the bearing bracket.

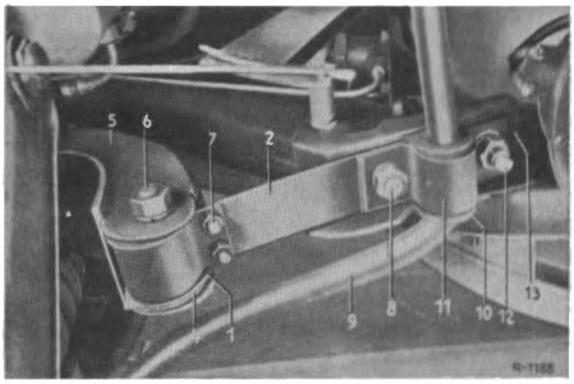


Fig. 33-1/13

1 Spacer ring
2 Flat spring
4 Rubber mounting
5 Bearing bracket at front axle support
6 Hexagon screw with nut and lock washer
7 Hexagon screw (clamping screw) with nut and lock washer
8 Square screw with nut and lock washer
9 Torsion bar
10 Rubber mounting for torsion bar
11 Bracket for rubber mounting
12 Eccentric
13 Bearing bracket on chassis base panel

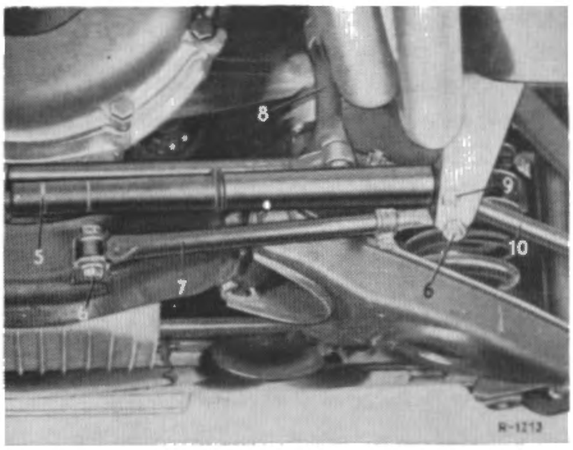


Fig. 33-1/14

5 Steering shock absorber
6 Hexagon screw with nut and lock washer
7 Strut for front axle lateral support
8 Steering relay arm
9 Hexagon screw with nut and lock washer
10 Right tie-rod

9. Unscrew the strut (7), which serves as a lateral support of the front axle, from the front axle support (Fig. 33-1/14).

Note: Models 190 c and 190 Dc have no front axle lateral support.

10. Detach the tie-rods left and right from the steering knuckle (see Job No. 46-9).

11. Remove the battery and on cars with carburetor engines remove the air intake silencer.

12. Place Supporting Bracket 111 589 03 31 for the engine right and left on the cowl. Suspend the engine by the water pump and raise it slightly (Fig. 33-1/15).

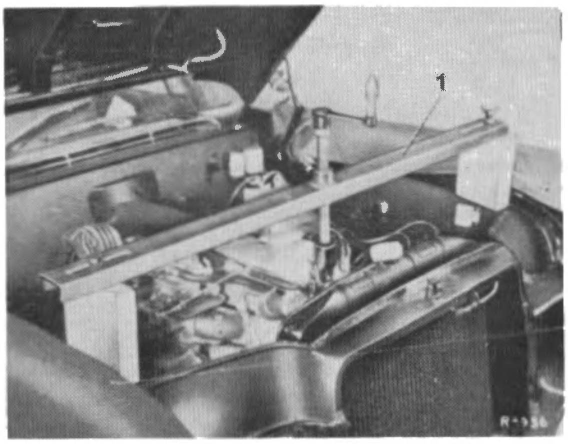


Fig. 33-1/15

1 Supporting Bracket 111 589 03 31 for the engine

13. Unscrew the two hexagon screws fixing the engine support (21) to the rubber mountings of the front engine suspension (see Fig 33-1/10).

14. Place a jack under the front axle support, using Fixture 111 589 02 63 (Fig. 33-1/18).

15. Unscrew the hexagon screw (6) of the rubber mountings (4) for the front axle suspension from the chassis base panel at the left and at the right and remove the stop plate (5) (Fig. 33-1/16).

16. Jack down the car and remove the front axle support with the front axle halves.

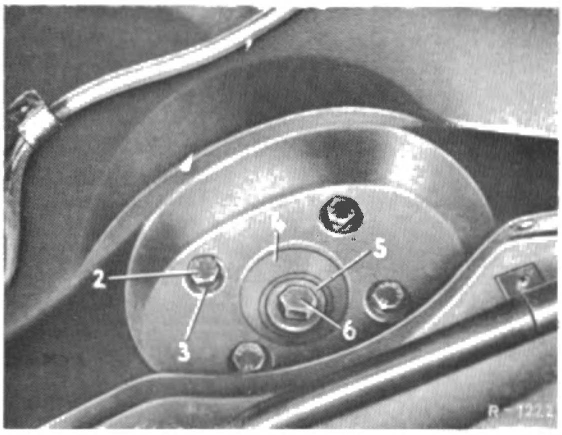


Fig. 33-1/16

2 Hexagon screws with lock washers
3 Washers
4 Rubber mounting
5 Stop plate
6 Hexagon screw with lock washer

Note: On Model 230 SL a stop (1) has been provided at the upper part of the front axle suspension in order to limit the upward spring travel of the rubber mounting (Figs. 33-1/16a and 16b).

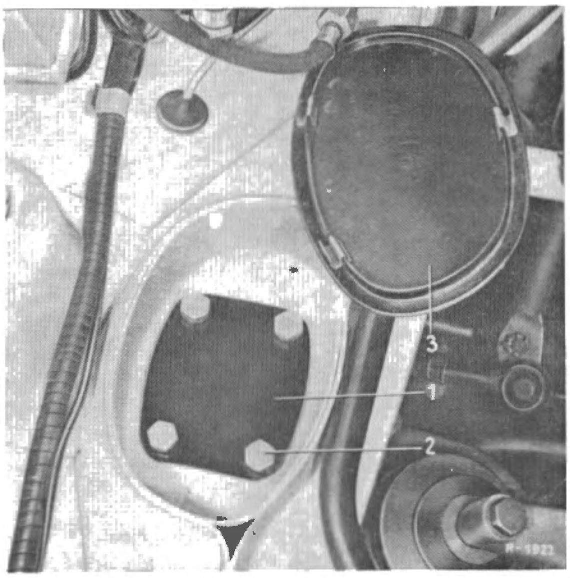


Fig. 33-1/16a

1 Stop
2 Hexagon screws with lock washers
3 Cover plate

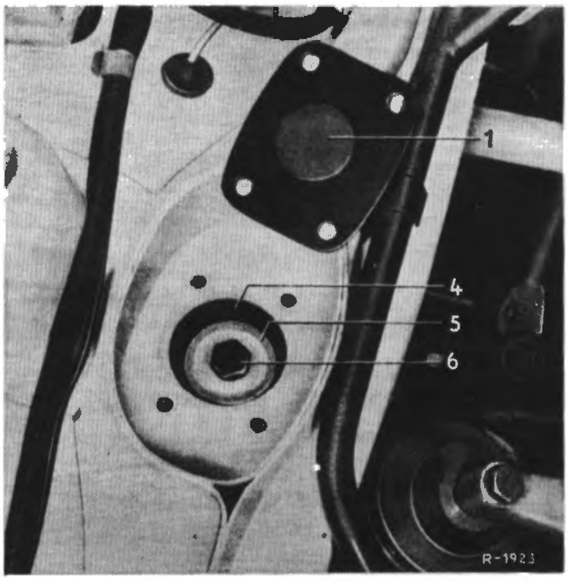


Fig. 33-1/16b

1 Stop
4 Rubber mounting
5 Stop plate
6 Hexagon screw with lock washer

Installation:

17. Check the two rubber mountings (4) for the front axle support and if necessary replace them. To do this slacken the four hexagon screws left and right on the chassis base panel (Fig. 33-1/17).

18. Check the rubber mountings (4) of the flat springs (2) for the longitudinal support of the front axle support (Fig. 33-1/19) and if necessary replace them (see Job No. 33-3).

19. Check the rubber mountings (1) of the strut for the lateral support of the front axle support and if necessary replace them (Fig. 33-1/21).

20. Place the front axle support with the front axle halves on the car jack in Fixture 111 589 02 63 (Fig. 33-1/18).

Models 220 b, 220 Sb, 220 SEb, 300 SE **Models 190 c, 190 Dc** **Model 230 SL**

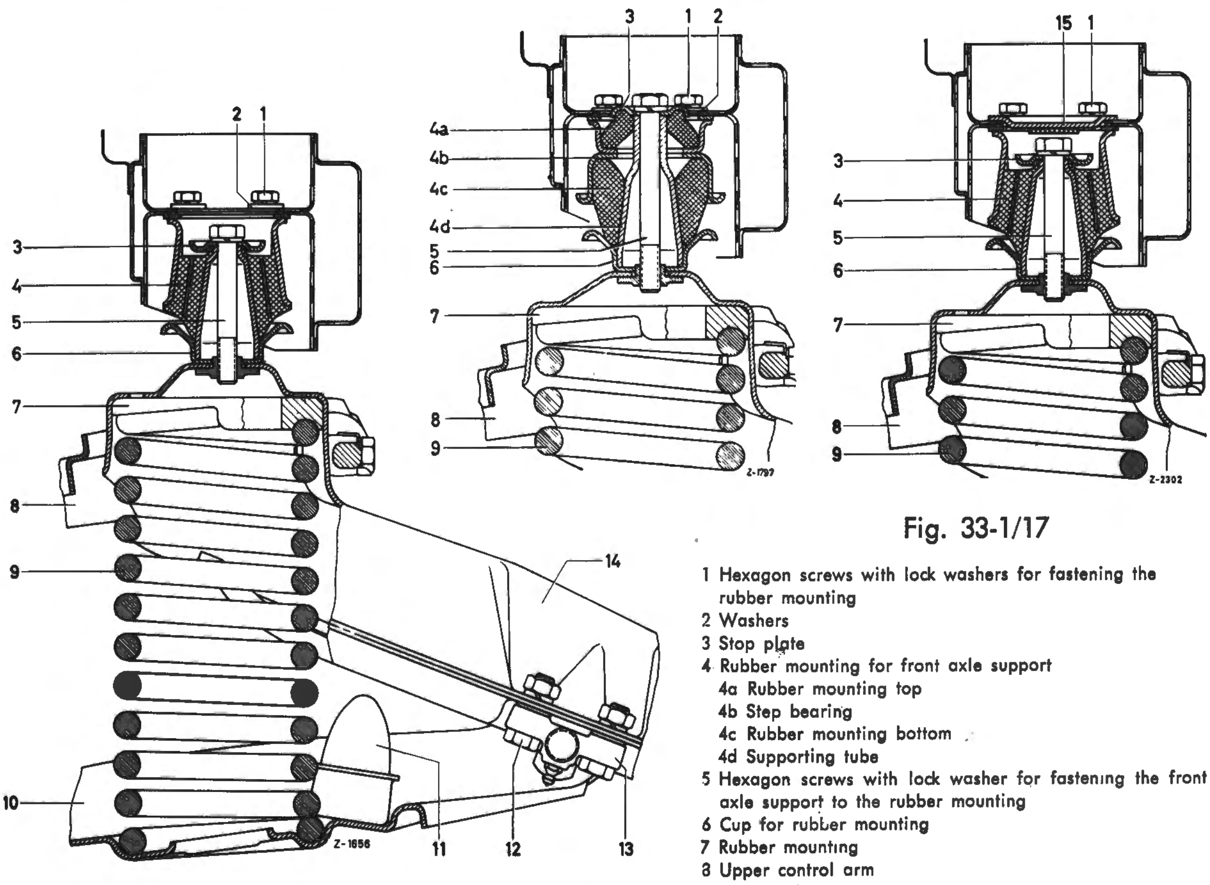


Fig. 33-1/17

1 Hexagon screws with lock washers for fastening the rubber mounting
2 Washers
3 Stop plate
4 Rubber mounting for front axle support
4a Rubber mounting top
4b Step bearing
4c Rubber mounting bottom
4d Supporting tube
5 Hexagon screws with lock washer for fastening the front axle support to the rubber mounting
6 Cup for rubber mounting
7 Rubber mounting
8 Upper control arm
9 Front spring
10 Lower control arm
11 Rubber buffer
12 Hexagon screws (M 12×1.5×38) with nuts and lock washers
13 Pivot pin for lower control arm
14 Front axle support
15 Stop

When repairs are being carried out, fit the hexagon screws (1) with the head upward.

Use only specified screws and nuts. For tightening torques see Job. No. 33-0.

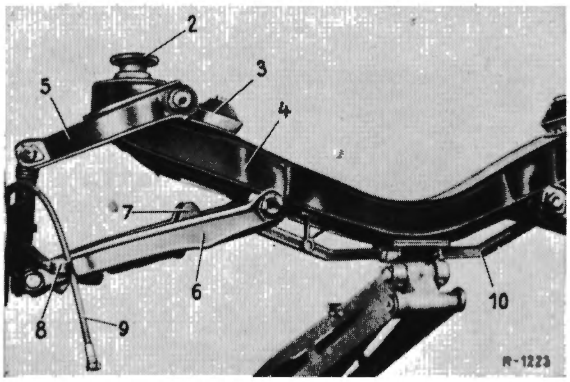


Fig. 33-1/18

2 Cup for rubber mounting of front axle support
3 Rubber mounting of front engine suspension
4 Front axle support
5 Upper control arm
6 Lower control arm
7 Rubber buffer
8 Steering knuckle
9 Brake hose
10 Fixture 111 589 02 63

21. Lift the front axle support, at the same time inserting the flat spring (2) at the left and at the right into the bearing bracket (5) on the front axle support (Fig. 33-1/19).

22. Screw the hexagon screw (5) for the front axle suspension on the chassis base panel at the left and at the right into the front axle support and tighten with the prescribed torque (see Job No. 33-0).

23. Fit the flat springs for the front axle longitudinal support into the front axle support but do not tighten the hexagon nuts yet (Fig. 33-1/19).

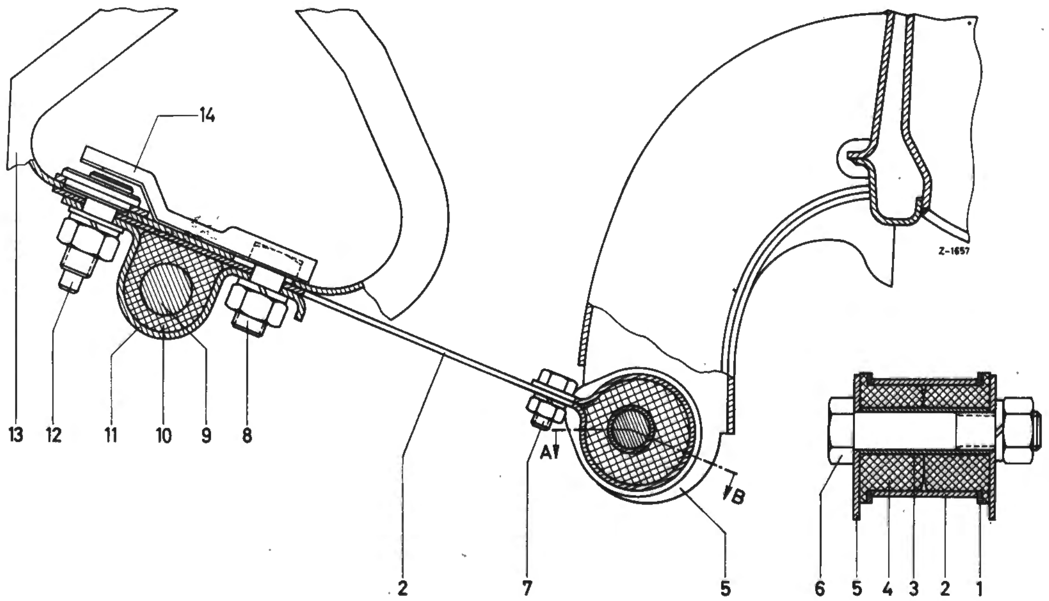


Fig. 33-1/19

1 Spacer ring
2 Flat spring
3 Spacer tube
4 Rubber mounting
5 Bearing bracket at front axle support
6 Hexagon screw with nut and lock washer
7 Hexagon screw (clamping screw) with nut and lock washer
8 Square screw with nut and lock washer
9 Torsion bar
10 Rubber mounting for torsion bar
11 Bracket for rubber mounting
12 Eccentric
13 Bearing bracket on chassis base panel
14 Cage for square screw and eccentric

Note: If the front axle support was removed together with the flat springs for the front axle longitudinal support, pay attention to the positions marked on the chassis base panel before removal. Tighten the hexagon nut on the eccentric (12) and the hexagon screw with the prescribed torque (see Job No. 33-0).

24. Screw on and tighten the two hexagon screws (4) for fastening the engine support (3) to the rubber mountings of the front engine suspension. Remove the supporting bracket for the engine (Fig. 33-1/1).

25. Install the front springs (see Job. No. 32-4).

26. Install the torsion bar (see Job. No. 32-6).

27. Install the front shock-absorbers (see Job No. 32-2).

28. Install the battery and on cars with carburetor engine install the air intake silencer.

29. Fit the right and left tie-rods on the steering knuckle (see Job No. 46-9).

30. Check the brake hoses (7) right and left and make sure that they fit tightly into the brake line. Loosen the hexagon screw (5) on the retainer (1) and insert the brake hose in the protection plate (6) at the retainer (1). Take care that the hose is not twisted. Tighten the hexagon nut (5) on the retainer. Fit the brake hose retainer (2), screw the sleeve nut (4) of the brake line (3) into the brake hose and tighten, holding the brake hose steady (Fig. 33-1/2).

31. Bleed the brake system.

32. Pull the center brake cable (5) through the guide on the front axle support and fit it to the hand-brake lever (4) Fig. 33-1/2).

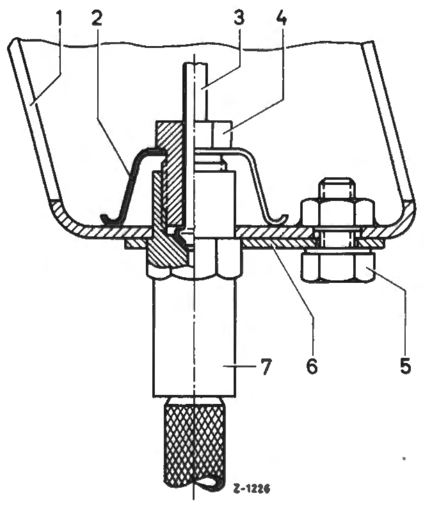


Fig. 33-1/20

1 Retainer at chassis base panel
2 Brake hose retainer
3 Brake line
4 Sleeve nut
5 Hexagon screw with spring washer
6 Protection plate
7 Brake hose

33. Fit the cotter pin (6) for securing the brake cable at the lower end of the lever (Fig. 33-1/12). Adjust the hand brake (see Job No. 42-20).

34. Fit the front wheels and the brake drums, jack down the car, and tighten up the wheel nuts.

35. Check the front axle positioning distance as well as the camber, caster and toe-in of the front wheels and, if necessary, adjust (see Job No. 40-3).

36. Mount the strut for the lateral support of the front axle (Fig. 33-1/21). Make sure that the rubber mountings for the front axle support are not under stress. Tighten the hexagon screw (5) of the clamp (6).

Note: The clamp of the strut should only be tightened with the front axle under load (i. e. the road wheels must be on the ground).
The strut must always be fitted in such a way that the clamp side points to the bearing bracket on the chassis base panel and the screw side of the clamp points toward the front (Figs. 33-1/14 and 33-1/21).

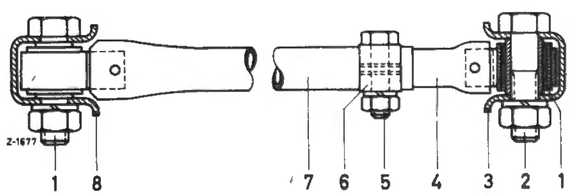


Fig. 33-1/21

1 Rubber mounting
2 Hexagon screw with nut and lock washer
3 Mounting hole on chassis base panel
4 Adjustable inside tube
5 Hexagon screw (clamping screw) with nut and lock washer
6 Clamp
7 Outside tube
8 Bearing bracket on front axle support
9 Hexagon screw

Removal and Installation of Front Axle Halves

Job No.
33-2

Modification: 2nd Version Front Axle (Addition)

Removal:

1. Remove the front axle support together with the two front axle halves (see Job No. 33-1).

2. Loosen the two hexagon screws (5) fastening the pivot pin (6) for the upper control arm to the front axle support, after tapping up the locking plates (4), and remove together with the shims (3) (Fig. 33-2/1).

Note: When removing the shims watch the order of their arrangement (see note to No. 4).

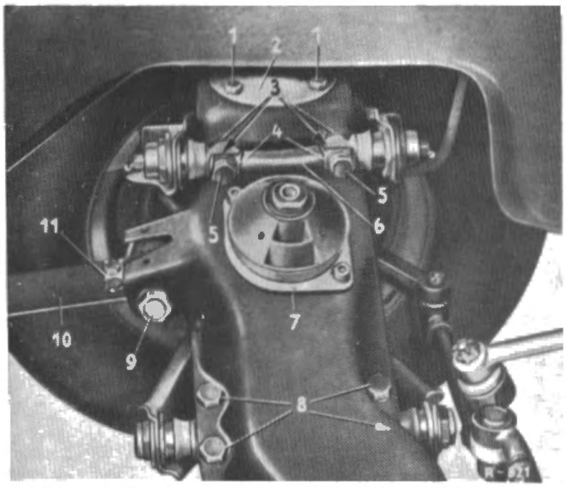


Fig. 33-2/1

1 Hexagon screws for fastening the rubber mounting to the front axle support
2 Rubber mounting
3 Shims
4 Locking plate
5 Hexagon screw (M 12×1.5×40)
6 Pivot pin for upper control arm
7 Rubber mounting of front engine suspension
8 Hexagon screws (M 12×1.5×38)
9 Pin for fastening the flat spring to the front axle support
10 Flat spring supporting the front axle support
11 Hexagon screws (clamping screws) for the rubber mounting of the flat spring

3. Loosen the hexagon screws (8) provisionally fixing the lower control arm, and take off the front axle half (Fig. 33-2/1).

Installation:

4. Install the front axle half and fasten the upper control arm to the front axle support with the two hexagon screws (5). Take care to observe the correct order of the shims (3) between the pivot pin and the front axle support. If necessary replace the locking plates (4) for the screws (Fig. 33-2/2).

When carrying out repairs, mount the locking plates in such a way that the lug at the screw head can be tapped over at the top and not below as is shown in the drawing. Tighten the hexagon screws with the prescribed torque (see Job. Nr. 33-0).

Upper control arm mounting on front axle

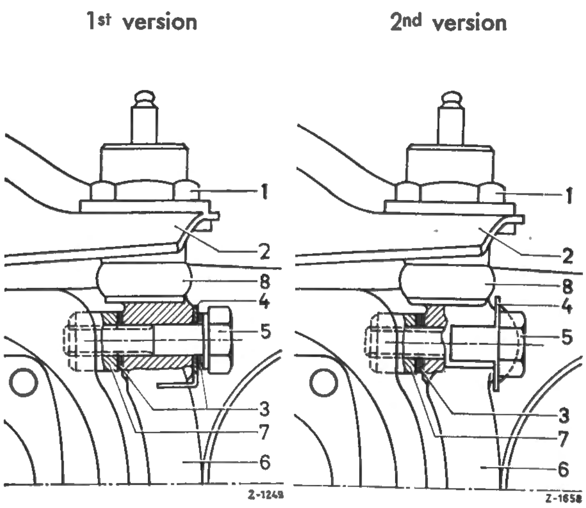


Fig. 33-2/2

1 Threaded bushing for upper control arm
2 Upper control arm
3 Shim
4 Locking plate
5 Hexagon screw (M 12×1.5×40)
6 Pivot pin for lower control arm
7 Front axle support
8 Rubber sealing ring

Note: The shims (3) are used for additional adjustment of the front wheel camber if the eccentric adjustment at the steering knuckle should not be sufficient.

In the case of the 1st version front axle a shim 2 mm thick has normally been inserted between the front axle support and the pivot pin and between the locking plate and the hexagon screw (Fig. 33-2/2).

In the case of the 2nd version front axle a shim 2 mm thick has normally been inserted between the front axle support and the pivot pin (Fig. 33-2/2a).

If a shim between the front axle support and the pivot pin is removed, it must be inserted between the locking plate and the hexagon screw.

In any case shims with a total thickness of 2 mm must be installed. Under no circumstances must the shims be omitted; otherwise there is a danger that the screw will knock against the front spring.

5. Fasten the lower control arm provisionally to the front axle support.

6. Install the front axle support with the front axle halves (see Job No. 33-1).

Removal and Installation of Rubber Mounting for Front Axle Longitudinal Support

Job No.
33-3

Removal:

1. Loosen the two hexagon screws (clamping screws) (4) on the flat spring (8) for the front axle longitudinal support (Fig. 33-3/1).

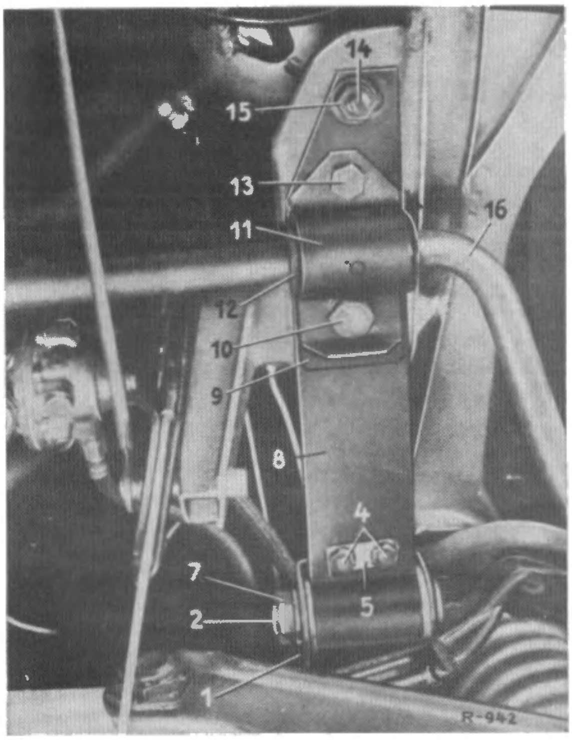


Fig. 33-3/1

1 Bearing bracket on front axle support
2 Bolt
4 Hexagon screws (clamping screws)
5 Locking plate
7 Hexagon nut with spring washer
8 Flat spring
9 Locking plate for rubber mounting
10 Hexagon screw (M 14×1.5×25 with spring washer
11 Bracket for rubber mounting
12 Rubber mounting for torsion bar
13 Hexagon screw (M 12×1.5×25) with spring washer
14 Eccentric
15 Hexagon nut with spring washer and washer
16 Torsion bar

2. Detach the flat spring mounting on the front axle support (Fig. 33-3/1).

3. Unscrew the hexagon screws (10) and (13) and press the flat spring off the bearing bracket (Fig. 33-3/1).

Note: The flat spring need not be removed when the rubber mountings are being replaced; therefore do not loosen the hexagon nut (15) on the eccentric (14). If for some reason the flat spring is removed, its position on the chassis base panel should be marked beforehand with a scriber.

4. Remove rubber mountings (3), spacer rings (18) and spacer tube (19) from the flat spring (Fig. 33-3/2).

Note: On some 1st version cars rubber mountings (3) were used with a vulcanized spacer tube (33-3/2).

Installation:

5. Check the rubber mountings (see Table in Job No. 33-0) and rub them with talc.

6. Insert the rubber mountings in the flat spring with the spacer rings installed and press in the spacer tube.

Note: The projection on the rubber mounting must engage the clamping gap in the flat spring. Do not yet tighten the hexagon screws (clamping screws) (4) (Fig. 33-3/2).

7. Fasten the flat spring to the front axle support; but do not yet tighten the hexagon nut (7) (Fig. 33-3/2).

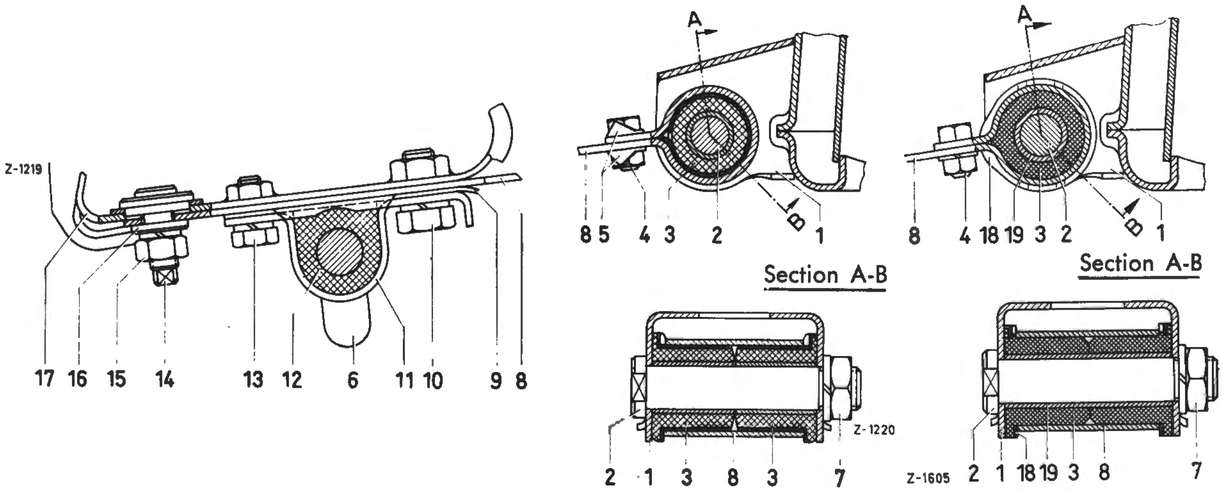
8. Fasten the flat spring together with the torsion bar to the chassis base panel making sure that the locking plate (9) and the rubber mounting in the bracket (11) are correctly positioned (Fig. 33-3/2). For the prescribed torque see Job No. 33-0.

9. Tighten the two hexagon screws (clamping screws) (4) with the prescribed torque (see Job No. 33-0) (Fig. 33-3/2).

Note: a) The clamping screws for the rubber mountings should not be tightened before the flat spring has been fixed in position in relation to the front axle support and the chassis base panel. This is necessary to prevent stress conditions and to obtain a smooth running of the front wheels.

b) On recent cars the clamping screws are no longer secured by means of locking plates, but by lock washers (Fig. 33-3/2).

10. Tighten the hexagon nut (7) for the bolt (2) on the front axle support (for prescribed torque see Job No. 33-0).



Rubber mounting with vulcanized spacer tube (previous version)

Rubber mounting with loose spacer tube (subsequent version)

Fig. 33-3/2

1 Bearing bracket
2 Bolt
3 Rubber mounting for flat spring
4 Hexagon screw with nut
5 Locking plate
6 Torsion bar
7 Hexagon nut with spring washer
8 Flat spring
9 Locking plate
10 Hexagon screw (M 14×1.5×25) with spring washer
11 Bracket for rubber mounting
12 Rubber mounting for torsion ba
13 Hexagon screw (M 12×1.5×25)
14 Eccentric
15 Hexagon nut with spring washer
16 Washer
17 Chassis base panel
18 Spacer ring
19 Spacer tube

B. 2nd Version Front Axle

Modification: Fig. 33-3/3 corrected

Removal:

1. Loosen the two hexagon screws (clamping screws) (7) on the flat spring (2) for the front axle longitudinal support (Fig. 33-3/3).

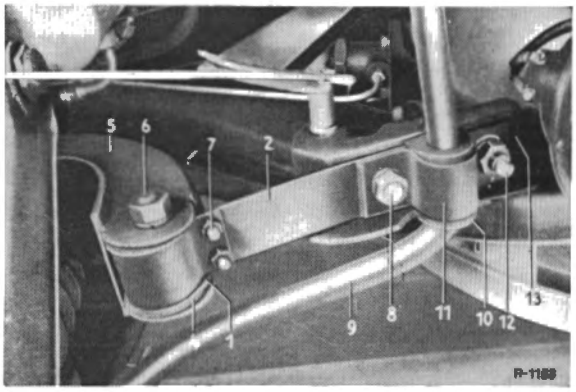


Fig. 33-3/3

1 Spacer ring
2 Flat spring
4 Rubber mounting
5 Bearing bracket on front axle support
6 Hexagon screw with nut and locker washer
7 Hexagon screw (clamping screw) with nut and lock washer
8 Square screw with nut and lock washer
9 Torsion bar
10 Rubber mounting for torsion bar
11 Bracket for rubber mounting
12 Eccentric
13 Bearing bracket on chassis base panel

2. Detach the flat spring mounting on the front axle support (Fig. 33-3/3).

3. Carefully mark the position of the flat spring on the chassis base panel by means of a scriber.

4. Detach the flat spring at the chassis base panel and remove together with the bracket (11) for the rubber mounting (10) of the torsion bar (Fig. 33-3/3).

5. Remove rubber mountings (4), spacer rings (1) and spacer tube (3) from the flat spring (Fig. 33-3/4).

Installation:

6. Check the rubber mountings (see Table in Job No. 33-0) and rub them with talc.

7. Insert the rubber mountings in the flat spring with the spacer rings installed and press in the spacer tube.

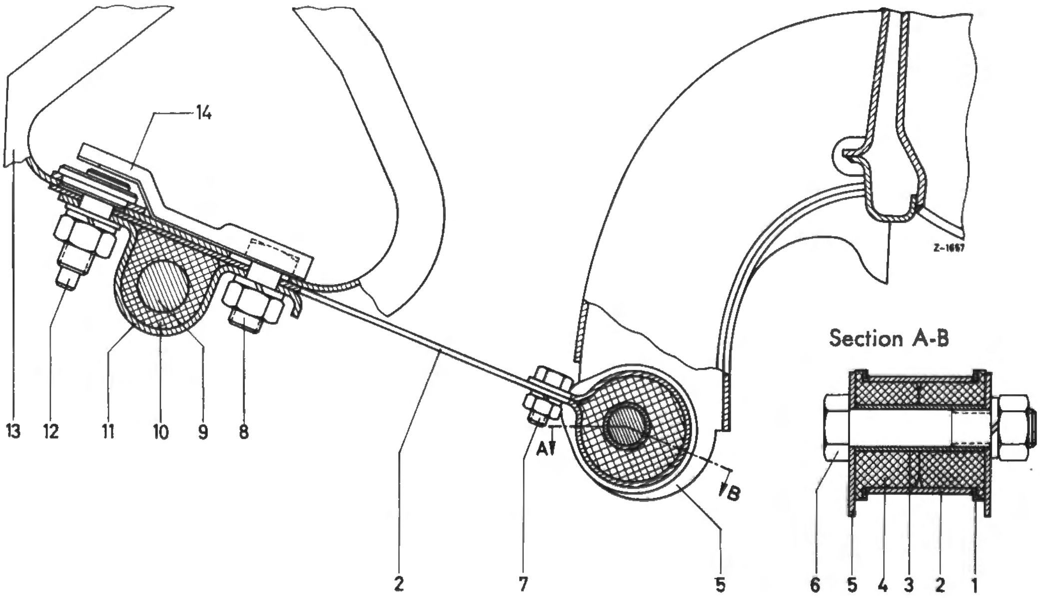


Fig. 33-3/4

1 Spacer ring
2 Flat spring
3 Spacer tube
4 Rubber mounting
5 Bearing bracket on front axle support
6 Hexagon screw with nut and lock washer
7 Hexagon screw (clamping screw) with nut and lock washer
8 Square screw with nut and lock washer
9 Torsion bar
10 Rubber mounting for torsion bar
11 Bracket for rubber mounting
12 Eccentric with hexagon nut and lock washer
13 Bearing bracket on chassis base panel

Note: The projection on the rubber mounting must engage the clamping gap in the flat spring. Do not yet tighten the hexagon nuts (clamping screws) (7) (Fig. 33-3/2).

8. Fasten the flat spring to the front axle support, but do not yet tighten the hexagon nut (Fig. 33-3/4).

9. Fasten the flat spring together with the torsion bar to the chassis base panel, paying attention to the markings made during removal showing the position of the flat spring. Also make sure that the rubber mounting of the torsion bar is correctly seated in the bracket. For tightening torque of the hexagon nut see Job No. 33-0.

10. Tighten the two hexagon·screws (clamping screws) (7) with the prescribed torque (see Job No. 33-0) (Fig. 33-3/4).

Note: a) The clamping screws (7) for the rubber mountings should not be tightened before the flat spring has been fixed in position in relation to the front axle support and the chassis base panel. This is necessary to prevent stress conditions and to obtain a smooth running of the front wheels.

11. Tighten the hexagon screw (6) on the front axle support (for the prescribed torque see Job No. 33-0).

Front Wheel Bearings

Job No.
33-5

Removal, Disassembly, Checking, Repair, Reassembly, and Installation of Front Wheel Hub, Adjustment of Front Wheel Bearings

Front Axle Half Installed

Modification: Note to para 18

In the case of cars with air suspension pay attention to "General Instructions for Assembly Work" (see Job No. 32-11).

Removal:

1. Remove the brake drum, and in the case of the disk brakes remove the brake caliper (1) (see Fig. 33-5/4 and Job No. 42-7).

2. Pull the hub cap (1) off the front wheel hub by means of Puller 180 589 00 33 (Fig. 33-5/1).

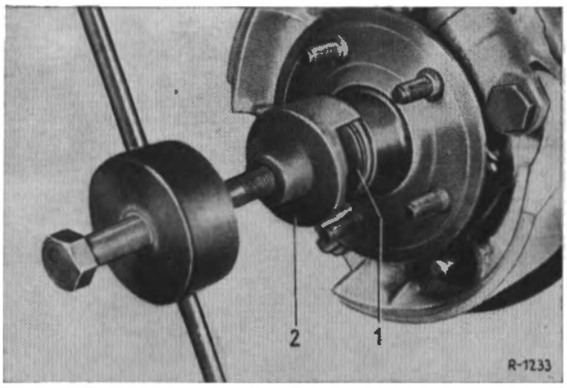


Fig. 33-5/1

1 Hub cap
2 Puller 180 589 00 33

3. Slacken the hexagon socket screw of the clamping nut (1) on the wheel spindle, remove the clamping nut and the washer (Fig. 33-5/2).

4. Pull off the front wheel hub using Puller 136 589 15 33, if necessary.

Disassembly:

5. Take the inner race with roller cage (6) of the outer annular taper roller bearing out of the hub (Fig. 33-5/3).

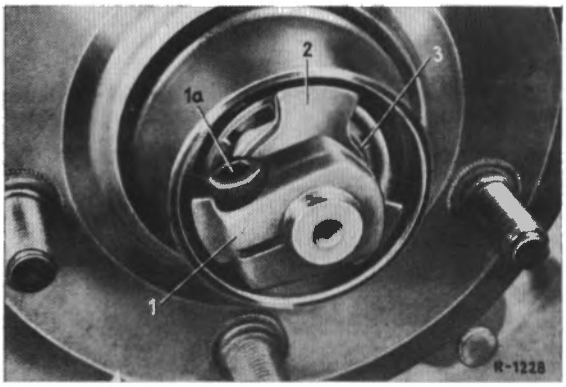


Fig. 33-5/2

1 Clamping nut
1a Hexagon socket screw with lock washer
2 Washer
3 Outer annular taper roller bearing

6. Use a suitable brass or aluminium drift to evenly tap the outer race (4) of the inner annular taper roller bearing and take the inner race with roller cage (3), the puller ring (2) and the seal (1) out of the front wheel hub (Fig. 33-5/3).

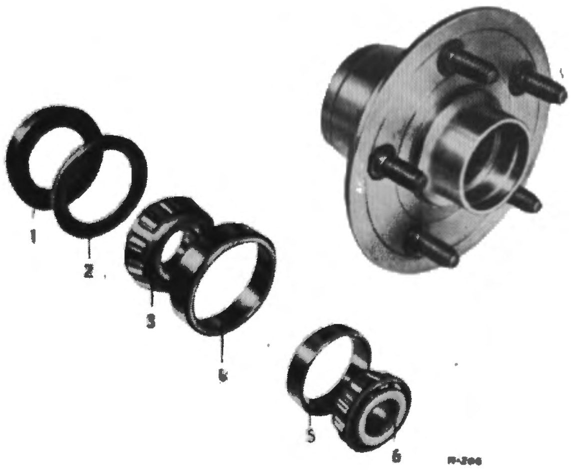


Fig. 33-5/3

1 Seal
2 Puller ring
3 Inner race with roller cage of inner annular taper roller bearing
4 Outer race
5 Outer race
6 Inner race with roller cage of outer annular taper roller bearing

7. Use a brass or aluminum drift in the same way to tap the outer race (5) of the outer annular taper roller bearing carefully out of the hub (Fig. 33-5/3).
8. In the case of front wheel hubs for disk brakes remove the brake disk (see Job No. 42-11).

Checking and Repair:

9. Check the flange of the front wheel hub for run-out (for dimensions see Job No. 33-0).
10. Check the wheel fixing bolts to make sure that they are tightly fixed in the hub.
11. Check the annular taper roller bearing and the bearing mountings in the front wheel hub and check the wheel spindle (for dimensions see Job No. 33-0).
12. Check the contact surface for the seal on the wheel spindle.

Note: In the case of the 1st version front wheel bearings (annular taper roller bearing with millimeter measurements) a spacer ring (6) is pressed on the wheel spindle and its contact surface for the seal (5) is provided with a reverse thread pattern (Fig. 33-5/4).

In the case of the 2nd version front wheel bearings (annular taper roller bearing with inch measurements) the seal (4) turns on the wheel-spindle, which is provided with a reverse thread pattern (Fig. 33-5/4a).

13. If on the 1st version of the front wheel bearings the contact surface for the seal on the spacer ring (6) is worn, replace the spacer ring (6). To do this heat the ring by means of a welding torch to about 80° C and remove it from its seat on the wheel spindle. Shrink on a new heated spacer ring paying attention to the assembly instructions in Job No. 33-0. The contact surface of the spacer ring should only be reconditioned in an emergency.
In the case of the 2nd version front wheel bearings remachine the contact surface for the seal on the wheel spindle, if necessary (for dimensions see Job No. 33-0). This can only be done after the steering knuckle has been removed (see Job No. 33-6). In this case the reserve thread pattern need not be applied.
14. Check the washer which is ground on both sides (2) and, if necessary, regrind or replace it (Fig. 33-5/2).

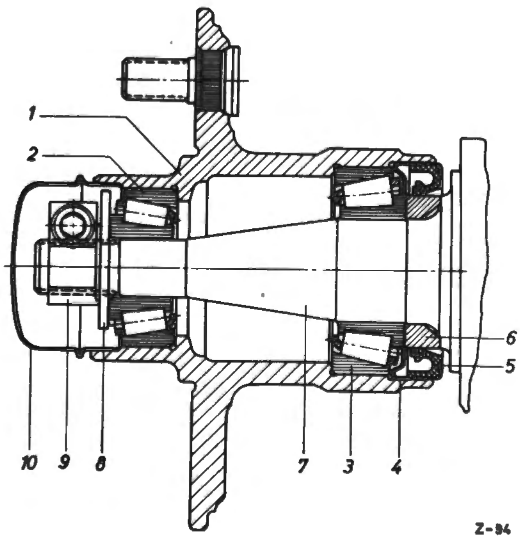


Fig. 33-5/4

1st version front wheel bearings

1 Front wheel hub
2 Outer annular taper roller bearing
3 Inner annular taper roller bearing
4 Puller ring
5 Seal
6 Spacer ring
7 Wheel spindle
8 Washer
9 Clamping nut
10 Hub cap

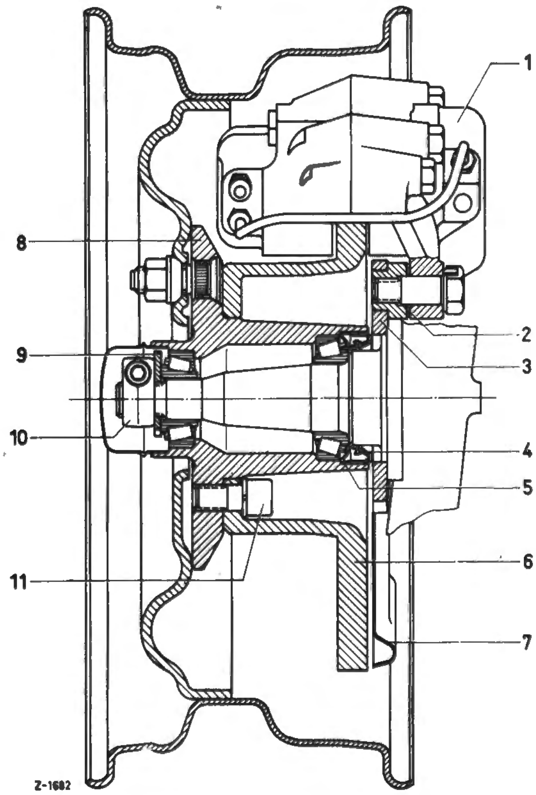


Fig. 33-5/4a

2nd version front wheel bearings

1 Brake caliper
2 Shim
3 Bracket for brake caliper
4 Seal
5 Puller ring
6 Brake disk
7 Cover plate
8 Front wheel hub
9 Washer
10 Clamping nut
11 Hexagon socket screw with lock washer

15. If necessary, check the wheel spindle for run-out (see Job No. 33-6).

Reassembly:

16. Press the outer races (2) and (3) of the annular taper roller bearings into the front wheel hub using Assembly Fixture 120 589 03 61 in the case of the 1st version front wheel bearings and Assembly Fixture 111 589 13 61 in the case of the 2nd version front wheel bearings (Figs. 33-5/5 and 33-5/6).

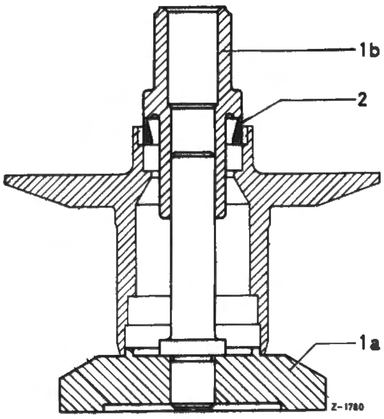


Fig. 33-5/5

Pressing in of outer race of outer annular taper roller bearing

1 Assembly Fixture 120 589 03 61 or 111 589 13 61
1a Base plate with guide pin
1b Pressure sleeve for outer race of outer annular taper roller bearing
2 Outer race of outer annular taper roller bearing

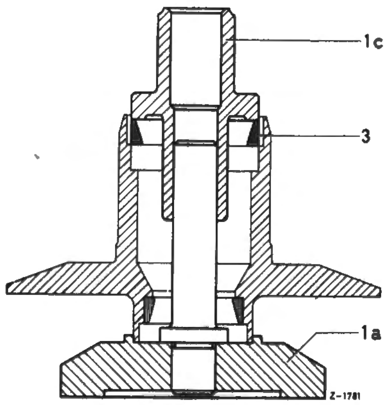


Fig. 33-5/6

Pressing in of outer race of inner annular taper roller bearing

1 Assembly Fixture 120 589 03 61 or 111 589 13 61
1a Base plate with guide pin
1c Pressure sleeve for outer race of inner annular taper roller bearing
3 Outer race of inner annular taper roller bearing

17. Install the inner race and roller cage of the inner annular taper roller bearing together with the puller ring (Figs. 33-5/4 and 4a).

Note: Before assembly fill the roller cages with antifriction bearing grease (for prescribed amount see Job No. 33-0).

18. Coat the circumference of the seal (4) with sealing compound and press in by means of Assembly Fixture 120 589 03 61 or 111 589 13 61 (Fig. 33-5/7).

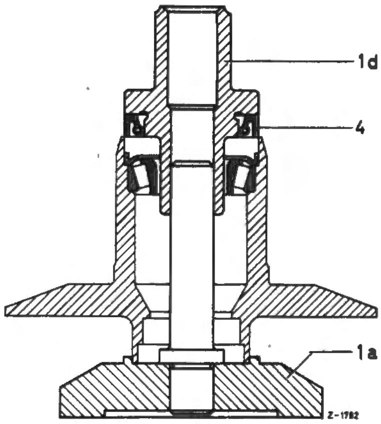


Fig. 33-5/7

Pressing in of seal

1 Assembly Fixture 120 589 03 61 or 111 589 13 61
1a Base plate with guide pin
1d Pressure sleeve for seal
4 Seal

Note: On a comparatively large number of cars with the 2nd version front wheel bearings seals were installed which are provided with a reverse thread pattern on the contact surface. If such seals are used for repair job, please note the assembly instructions L = left side and R = right side.

The seals now used have no reverse thread pattern and left and right are identical (see also Job No. 33-0).

19. Put anti-friction bearing grease in the front wheel hub (for prescribed amount see Job No. 33-0).

Note: Always put in the prescribed amount of grease. If the amount of grease is excessive the kneading action causes overheating of the grease and as a result it may lose its lubrication properties. On the other hand, the amount of grease must not be too small since this may prejudice proper lubrication of the annular taper roller bearings.

20. In the case of a front axle with disk brake install the brake disk on the front wheel hub (see Job No. 42-11).

Installation:

21. Coat the contact surface for the seal on the spacer ring or on the wheel spindle with Molykote paste (Figs. 33-5/4 and 4a).

22. Press the wheel hub onto the wheel spindle. Install the inner race and roller cage of the outer annular taper roller bearing. Put on the ground steel washer and screw on the clamping nut.

Adjustment of Front Wheel Bearings:

23. Tighten the clamping nut to such an extent that the hub can just be turned. Then slacken the clamping nut and neutralise the stresses by a blow on the wheel spindle.

24. Attach Tester 136 589 04 21 to the hub and adjust the dial gage to an initial tension of approx. 2 mm (Fig. 33-5/8).
Check the end play of the hub by vigorously pulling and pushing the flange. Turn the hub several times before making any measurements.

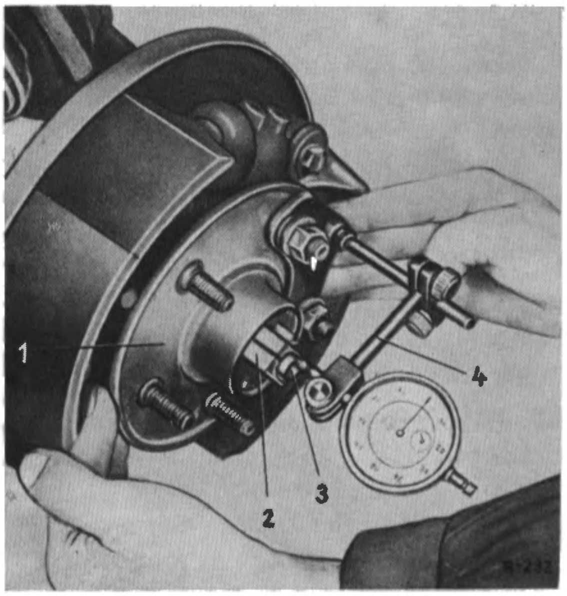


Fig. 33-5/8

1 Front wheel hub
2 Clamping nut
3 Wheel spindle
4 Tester 136 589 04 21 with dial gage

26. Tighten the hexagon socket screw of the clamping nut and recheck the end play.

27. **Make an additional check** by turning the ground washer between the inner race of the outer annular taper roller bearing and the clamping nut (Fig. 33-5/9, for checking instructions see Job No. 33-0).

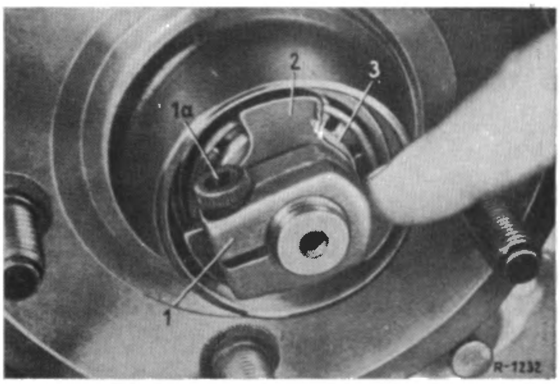


Fig. 33-5/9

1 Clamping nut
1a Hexagon socket screw
2 Washer
3 Outer annular taper roller bearing

28. Check the position of the notched socket pin (suppressor pin) in the wheel spindle and of the contact spring in the hub cap.

29. Put anti-friction bearing grease into the hub cap (for prescribed amount see Job No. 33-0) and press on the cap using Fixture 180 589 11 39 (Fig. 33-5/10).

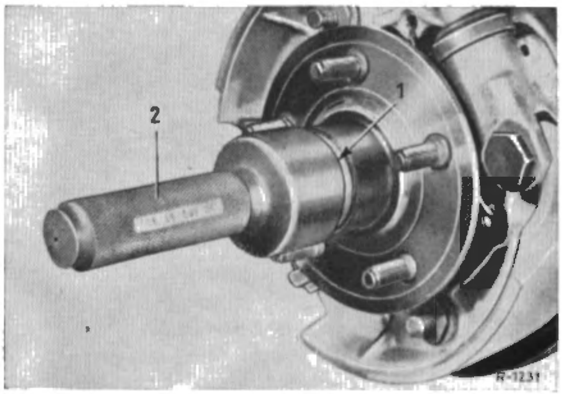


Fig. 33-5/10

1 Hub cap
2 Fixture 180 589 11 39

30. Install the brake drum or the brake caliper (see Job No. 42-7).

Job No.
35-0

Rear Axle

General Data, Dimensions, and Tolerances

*Modification: Models as from August 1965 added; other modifications marked **

Rear Axle Suspension

Models 190 c to 300 SEL

Distance between surface of joint flange and axle of support of rear axle suspension	mm	172 ± 1
Check distance "a" between surface of joint flange and support of rear axle suspension (see Fig. 35-4/21)	mm	158 ± 1

Rear Axle Oil Capacity

Models 190 c to 300 SEL

Capacity	2.5 ltr.

Caution! For rear axles with lock compensation differential only use spezial Oil.

Tightening Torques

Models 190 c to 300 SEL

Hexagon screws for fastening ring gear		mkg	8[1])
Grooved nut for annular grooved bearing or barrel roller bearing of rear axle shaft		mkg	20
Hexagon nuts of fitted screws for fastening brake anchor plate or seal retainer to axle tube		mkg	2.5
Hexagon screw at connecting pin		mkg	12
Hexagon screw at top of rubber mounting for support of rear axle suspension		mkg	18
Hexagon screws (clamping screws) in cover of rear axle bearing and in support of rear axle suspension		mkg	4.5
Shouldered castle nuts or hexagon nuts for fastening torque arms to chassis base panel		mkg	10
Hexagon screws for fastening torque arm to axle tube			20
Hexagon screws for fastening cover to front of rear axle housing	M 7	mkg	2.5[2])
	M 8	mkg	3.5[2])
Hexagon screws for fastening left axle tube with bearing flange to rear axle housing	M 8	mkg	2.5
	M 10	mkg	5
Tensioning screw for fastening the sliding joint to the differential side gear	8 G	mkg	4.5
	10 K	mkg	6.5
Hexagon socket screws for wheel fixing disk and brake disk on rear axle shaft		mkg	13.5
Hexagon socket screws of bearing caps for mounting of brake support on axle tube		mkg	2.5

[1]) The hexagon screws are **not** secured by locking plates.
[2]) Use only grade 10 K screws.

Anti-Friction Bearings

The following points must be taken into account when judging the serviceability of the bearings:

As a rule, a bearing can still be regarded as serviceable, if the raceways or contact surfaces and the balls or rollers show no visible signs of wear or damage. In order to form a really sound judgement, the bearing must previously be cleaned in gasoline or trichloroethylene until all traces of dirt have been rinsed out of the bearing. A bearing can be considered free from all traces of dirt if there are no binding spots when it is rotated by hand.

A few drops of extra-thin engine oil should be put on the cleaned bearing so that it can be tested for silent running. When this test is made, it should be remembered that even bearings which have only been in operation for a short period of time are appreciably noisier than new bearings, but this does not necessarily mean that they are unserviceable.

In order to avoid unnecessary rejection of bearings which are still serviceable, assessment of bearing serviceability should only be done by an expert who is experienced in this work.

Under normal running conditions, the radial play of a bearing should only show a slight increase during its lifetime.

When repairs are being carried out on a vehicle which has covered 100 000 km, the bearings should automatically be rejected even if examination shows that they are still serviceable. This is because their further period of serviceability is an unknown factor. But the decision must depend on whether replacement of the bearings is easy, i. e., on whether it can be done without any considerable disassembly and reassembly work or whether replacement involves considerable preparation.

Note: When new, the annular grooved bearing of the rear axle shaft has a radial play of from 0.020 to 0.037 mm which corresponds to an end play of from 0.20 to 0.37 mm.

When a bearing of this type is being examined for serviceability, the end play must be taken into account to avoid any unnecessary replacement. In order to ensure that the bearing lies properly against the shoulder of the rear axle shaft, only bearings which have an edge-to-edge dimension of 2+0.7 mm must be used (Fig. 35-0/10). For this reason, only special bearings, according to part number must be used.

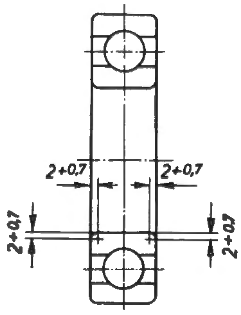


Fig. 35-0/10

Removal and Installation of Rear Axle

Job No.
35-1

Modification: Instructions for cars with air suspension added

Note: In the case of cars with air suspension see "General Instructions for Assembly Work" (See Job No. 32-11).

Removal:

1. Jack up the car at the rear. Remove the rear wheels and on cars with drum brakes remove the brake drums.
2. On cars with air suspension remove the torsion bar on the rear axle (see Job No. 32-9).
3. Unfasten the pipe clip on the rear exhaust pipe. Prize out the rubber rings (1) of the rear exhaust suspension with a screw driver, taking care not to damage them. Remove the rear exhaust pipe together with the intermediate muffler and the main muffler (Figs. 35-1/1 and 35-1/2).

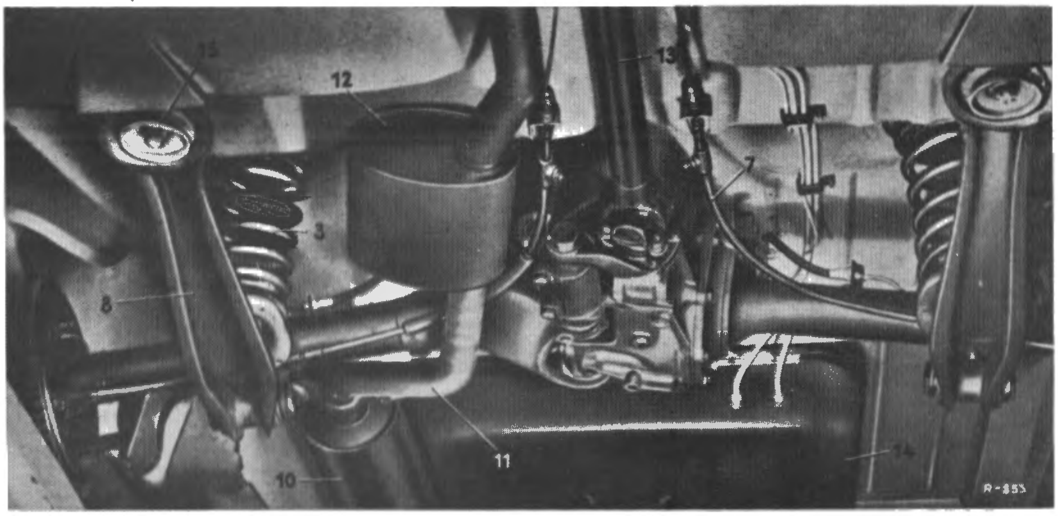


Fig. 35-1/1

3 Rear spring
7 Rear brake cable
8 Torque arm
10 Main muffler
11 Rear exhaust pipe
12 Intermediate muffler
13 Rear propeller shaft
14 Fuel tank
15 Front torque arm mounting

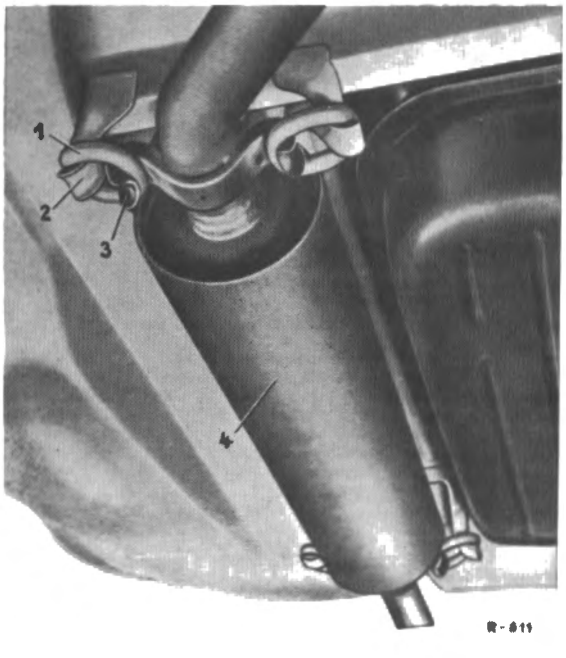


Fig. 35-1/2

1 Rubber ring
2 Retainer on chassis base panel
3 Retainer on the rear exhaust pipe
4 Main muffler

4. Loosen the wing nut (8) for adjusting the handbrake on the relay lever (5). Detach the return spring (2) on the bolt of the equalizer (3) and on the bracket. Unscrew the hexagon nuts fastening the two rear brake cables (1) to the brackets on the chassis base panel and disconnect the brake cables (Fig. 35-1/3 and Job No. 42-19).

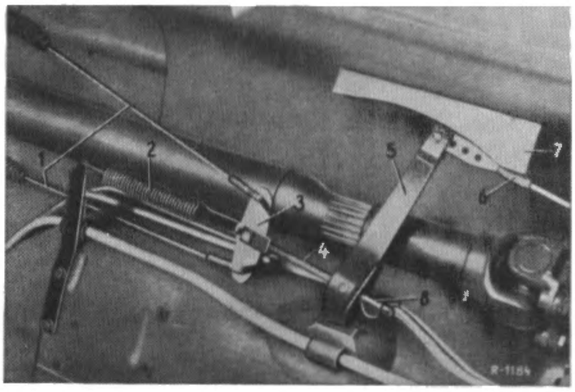


Fig. 35-1/3

2nd version

(For 1st version see Job No. 42-19)

1 Rear brake cables
2 Return spring
3 Equalizer
4 Tensioning screw
5 Relay lever
6 Center brake cable
7 Relay lever guide
8 Wing nut for the adjustment of the hand brake

5. Unscrew the propeller shaft at the joint flange of the rear axle and push the rear propeller shaft forward (Fig. 35-1/4).

6. Remove the compensating spring (see Job No. 32-7). This does not apply to cars with air suspension.

7. Remove the left and right rear springs (see Job No. 32-5). On cars with air suspension unscrew the spring piston from the torque arm, but do not remove it from the spring bellows (see also Job No. 32-13).

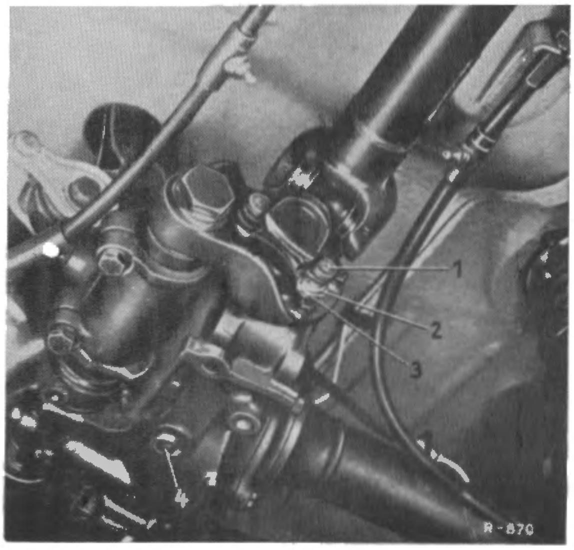


Fig. 35-1/4

1 Cheese head screws
2 Locking plates
3 Hexagon nuts
4 Oil drain plug

8. On cars with drum brakes detach the brake lines (4) from the wheel cylinders and the brake hoses (5) (Fig. 35-1/5). Remove the brake lines together with the brake hose retainers from the retainers on the axle tubes. On cars with disk brakes disconnect the brake hoses from the brake lines on the brake calipers (see Job Nos. 42-6 or 46-7).

9. Disconnect the torque arm mountings from the chassis base panel (see Job No. 35-2).

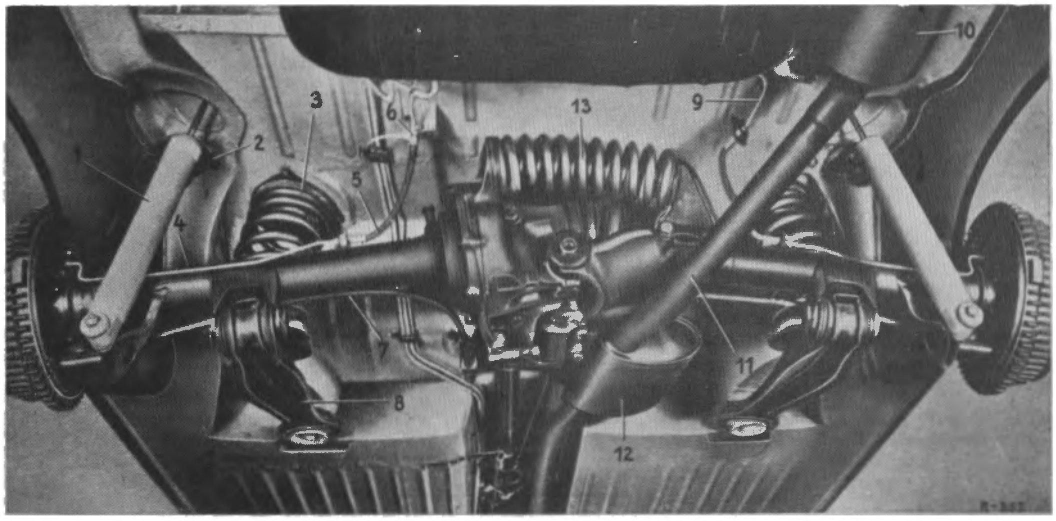


Fig. 35-1/5

1 Rear shock-absorber
2 Rubber buffer for axle tube
3 Rear spring
4 Brake line
5 Brake hose
6 Distributor fitting
7 Rear brake cable
8 Torque arm
9 Brake line (connection to left brake hose)
10 Main muffler
11 Rear exhaust pipe
12 Intermediate muffler
13 Compensating spring

10. Screw out the hexagon screws (8) and (10) on the front link (9) of the cross strut (5) for the rear axle. Take off the front link, loosen the rear link (7) a little and push the cross strut backward (Fig. 35-1/6).

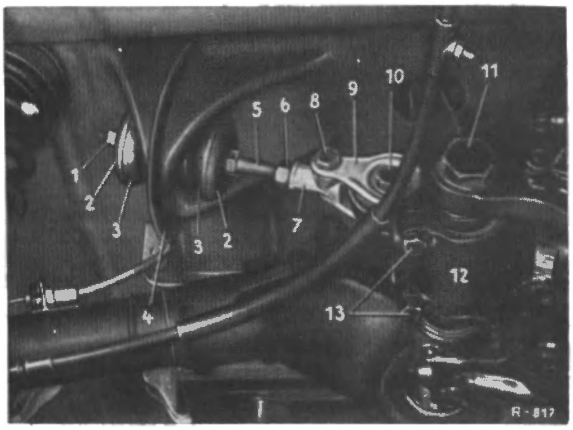


Fig. 35-1/6

1 Hexagon nut with lock nut
2 Cup
3 Rubber buffer
4 Retainer on chassis base panel
5 Cross strut
6 Hexagon nut (lock nut)
7 Rear link
8 Hexagon screw with spring washer
9 Front link
10 Hexagon screw with spring washer
11 Hexagon screw for connecting pin of the rear axle suspension
12 Support of the rear axle suspension
13 Hexagon screws (clamping screws)

11. On cars with air suspension disconnect the brake support mounting on the chassis base panel. To do this unscrew the castle nut in the interior of the car from under the rear seat and pull out the hexagon screw (4) (Fig. 35-1/10).

12. Raise the two axle tubes a little and loosen the lower shock-absorber suspension right and left. Remove the hexagon nut or hexagon screw together with lock washer cup and washer. Push the shock-absorber off the bolt (Fig. 35-1/7).

13. Raise the axle tubes until they are more or less horizontal. Fasten Supporting Bracket 111 589 07 61 to the rear axle and place the jack with Fixture 111 589 05 61 under the rear axle housing (Fig. 35-1/9).

14. From the trunk compartment unscrew the hexagon screw (1) on the rubber mounting (3) of the rear axle suspension and remove with the lock washer and the upper tension disk (2) (Fig. 35-1/8).

15. Lower the rear axle and remove from the jack.

Caution! When removing, installing or transporting the rear axle, supporting bracket 111 589 07 61 must be attached to prevent the axle tubes from dropping and thus to avoid damage to the rear axle housing and the sliding joint.

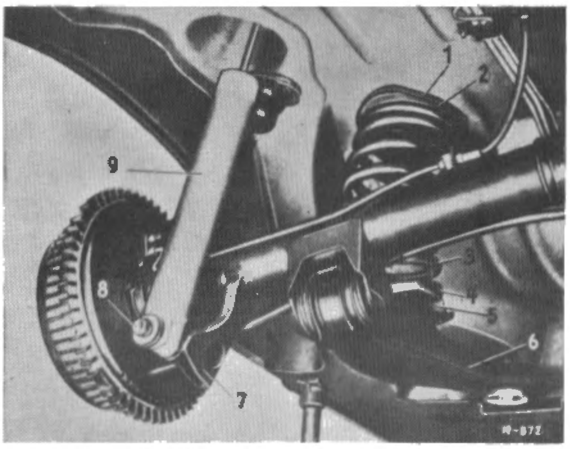


Fig. 35-1/7

1 Upper spring plate on chassis base panel
2 Upper rubber mounting
3 Rear spring
4 Lower rubber mounting
5 Lower spring plate
6 Torque arm
7 Bracket for lower shock-absorber suspension
8 Lower shock-absorber suspension
9 Shock-absorber

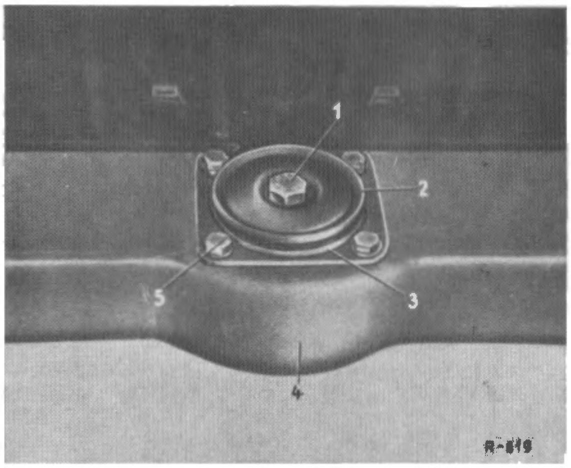


Fig. 35-1/8

1 Hexagon screw with lock washer
2 Upper tension disk
3 Rubber mounting
4 Cross member on chassis base panel
5 Hexagon screw for fastening the rubber mounting to the cross member

Installation:

16. Check the distance "a" between the surface of the joint flange and the support of the rear axle suspension. Check whether the support of the rear axle suspension forms a right angle with the left axle tube. The distance "a" and the angle between the support and the axle tube can be adjusted after loosening the 2 clamping screws on the rubber mounting (see Job No. 35-4 paras 35 and 35).
17. Check the spring plates and the rubber mountings or the spring pistons for the rear springs.

Note: If the spring plates are screwed off, look out for the correct position of the spring plates in accordance with the color code of the springs (see Job No. 32-0).

18. Check the step bearings for the torque arms at the chassis base panel and also their rubber rings and cups or mounting plates. Rub talc on the rubber rings (see Job No. 35-2).
19. Check the rubber buffers (3) for the cross strut (5) at the chassis base panel (Fig. 35-1/6). Check the rubber mounting (1) in the support (3) for the rear axle suspension (Fig. 35-1/9).
20. If necessary, remove the rubber mounting (3) of the rear axle suspension and check whether it can be used again. Fix the rubber mounting with the hexagon screws (5) to the chassis base panel (Fig. 35-1/8).

Note: On early models the lower tension disk is not connected to the rubber mounting (see Job No. 35-0).

21. Place the rear axle with Supporting Bracket 111 589 07 61 (4) on the Jack Fixture 111 589 05 61 (5). Insert the conical Installing Arbor 111 589 00 61 (2) in the bracket (3) of the rear axle suspension (Fig. 35-1/9).
22. Lift the rear axle and insert the support into the rubber mounting (3). Put on the upper tension disk (2) making sure that the disk is properly seated in the dowel pin. Screw in the hexagon screw (1) with the lock washer, let down the jack and tighten the hexagon screw with the specified tightening torque (Fig. 35-1/8 and Job No. 35-0).
23. Slightly raise the two axle tubes and remove the supporting bracket.
24. Let down the axle tubes and install the shock-absorbers (see Job No. 32-3).
25. Fasten the cross strut (5) with the two links (7) and (9) and the hexagon nuts (8) and (10) to the support of the rear axle suspension (Fig. 35-1/6).
26. Attach the torque arms to the chassis base panel (see Job No. 35-2).
27. Connect the brake lines (see Job Nos. 42-6 or 7).
28. Install the left and right rear springs (see Job No. 32-5). On cars with air suspension attach the spring piston to the torque arm taking care to ensure that the dowel pin fixing the spring piston is properly seated in the torque arm.
    Check the seat of the spring piston in the spring bellows (see also Job No 32-13).
29. Install the compensating spring (see Job No. 32-7). This does not apply to cars with air suspension.
30. On cars with air suspension attach the brake support to the side member (2). To

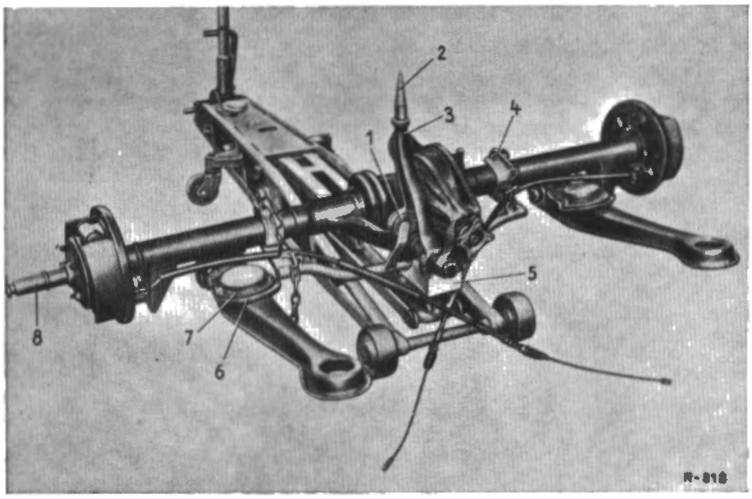


Fig. 35-1/9

1 Rubber mounting for cross strut
2 Conical Installing Arbor 111 589 07 61
3 Support of the rear axle suspension
4 Supporting Bracket 111 589 07 61
5 Jack Fixture 111 589 05 61
6 Lower rubber mounting for rear spring
7 Lower spring plate at the torque arm
8 Flange 111 589 01 63 for lifting the axle tubes

do this put the hexagon screw (4) together with cup and lower rubber buffer (5) through the lever for the brake support (3) from below.
Install the 2nd lower rubber buffer (5) together with cup and spacer tube (6) and the cup with the upper rubber buffer (7). Insert the hexagon screw (4) in the bore on the side member (2). Install the 2nd upper rubber buffer (7) together with cup (1), tighten the castle nut and cotter (Fig. 35-1/10).

33. Attach the rear brake cables (1) on the right and on the left to the bracket on the chassis base panel and to the equalizer (3). Tighten the hexagon nuts. Make sure that the rubber sleeves are seated correctly. Attach the return spring (2) (Fig. 35-1/3 and Job No. 42-19).

34. Fasten the propeller shaft the joint flange of the rear axle with the cheese head screws, new locking plates and, it necessary, new hexagon nuts (Fig. 35-1/3).

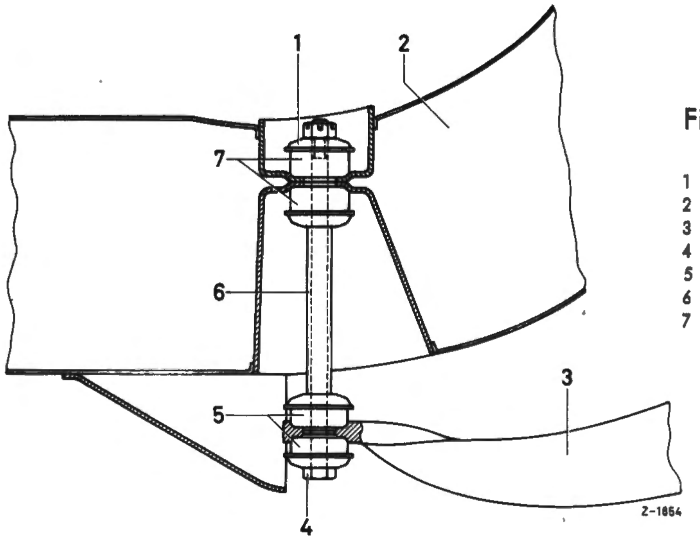


Fig. 35-1/10

1 Cup
2 Side member
3 Lever for brake support
4 Hexagon screw
5 Lower rubber buffer
6 Spacer tube
7 Upper rubber buffer

Note: The rubber buffers (5) and (7) should be installed on the hexagon screw (4) in such a way that their collars are carried in the bores provided for them. The low rubber buffers (5) are mounted on the lever for the brake support (3), the high rubber buffers (7) on the side member (2) (Fig. 35-1/10).

31. Install the rear exhaust pipe with the intermediate muffler and the main muffler, taking care not to damage the rubber rings of the rear suspension. If necessary replace the rubber rings. Make sure that the pipe clips are positioned properly and that the exhaust pipe is installed without forcing (Figs. 35-1/1 and 35-1/2).

32. On cars with air suspension install the torsion bar on the rear axle (see Job No. 32-9).

35. Install the brake drums and the rear wheels, lower the car and tighten the wheel nuts.
Check the oil level in the rear axle, and if necessary top up (for quantity and type of oil see Job No. 35-0).

36. Bleed the brakes.

37. Adjust the hand-brake (see Job No. 42-20).

38. After a short trial run check the center position and the axle positioning distance of the rear axle and if necessary correct (see Job No. 40-3).

Note: The center position and the axle positioning distance should not be checked till a trial run has been made; then, if necessary, it should be corrected.
However on cars with air suspension this test should be made **before** a trial run to avoid the danger of bellows rubbing against air chambers.

Cross Strut for Rear Axle Support

Job No.
35-1a

Removal, Checking and Installation

Modification: Revised, and Cross Strut for Model 230 SL added

Note: In order to remove the rear axle or to replace the rubber mounting in the support of the rear axle suspension only remove the front link (9) after loosening the hexagon screws (8) and (10). It is not necessary to remove the cross strut (5) with the rubber buffers and the rear link (7) (Fig. 35-1a/1).

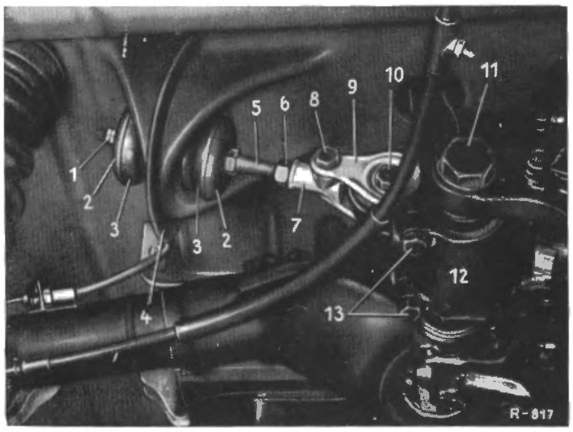


Fig. 35-1a/1

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE

1 Hexagon nut and lock nut
2 Cup
3 Rubber buffer
4 Retainer on chassis base panel
5 Cross strut
6 Hexagon nut (lock nut)
7 Rear link
8 Hexagon screw and spring washer
9 Front link
10 Hexagon screw and spring washer
11 Hexagon screw for connecting pin of the rear axle suspension
12 Support for rear axle suspension
13 Hexagon screws (clamping screws)

Removal:

1. Loosen the hexagon nut and the lock nut (1) (Fig. 35-1a/1).

2. Unscrew the hexagon screws (8) and (10) and remove the front link (9).

3. Push the cross strut (5), together with the rear link (7), slightly toward rear. Remove rubber buffers (3) and the cups (2). Pull out the cross strut.

Checking:

4. Check the cross strut for distortion. Porous rubber buffers and deformed cups must be replaced.

Note: When the cups become dished the pressure exerted by the rubber buffers is decreased. As a result the cross support of the rear axle is no longer accurate enough and the riding qualities of the car deteriorate.

Installation:

5. Slide the cup (2) and the rubber buffer (3) on the cross strut and insert them into the bracket on the chassis base panel for the rear axle support.

6. Press the rear link (7) into the rubber mounting in the bracket (12) for the rear axle suspension.

7. Fit the front link (9) and screw in the hexagon screws (8) and (10) but do not tighten them yet.

8. Slide the outer rubber buffer (3) and the cup (2) on the cross strut (5) and screw on and tighten the hexagon nut with the lock nut (1).

9. Tighten the hexagon screws (8) and (10).

10. Check the center position and the axle positioning distance of the rear axle and adjust if necessary (see Job No. 40-3).

Modifications concerning Removal and Installation of Cross Strut of Model 230 SL

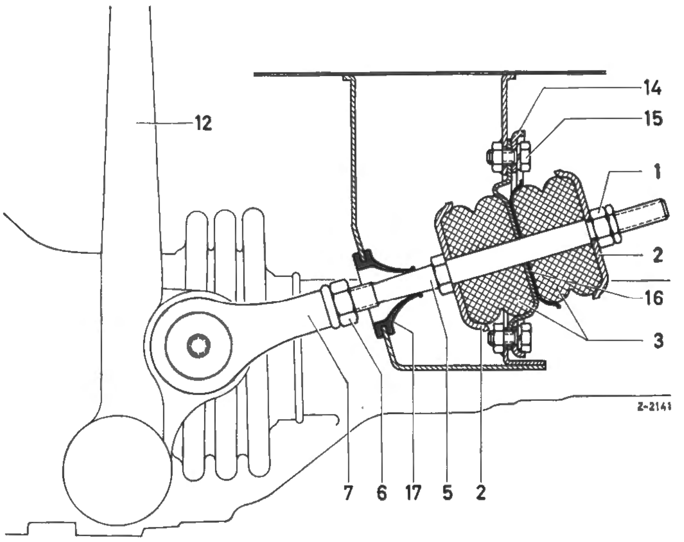


Fig. 35-1a/2

1 Hexagon nut and lock nut
2 Cup
3 Rubber buffer
5 Cross strut
6 Hexagon nut (lock nut)
7 Link
12 Support for rear axle suspension
14 Retainer for rubber buffers
15 Hexagon screw
16 Intermediate cup for rubber buffers
17 Cuff for side support

In principle the arrangement of the cross strut is the same as on other models. In order to remove the inner rubber buffer (3) the retainer for the rubber buffers (14) must be removed after the five hexagon screws (15) have been unscrewed (Fig. 35-1a/2).

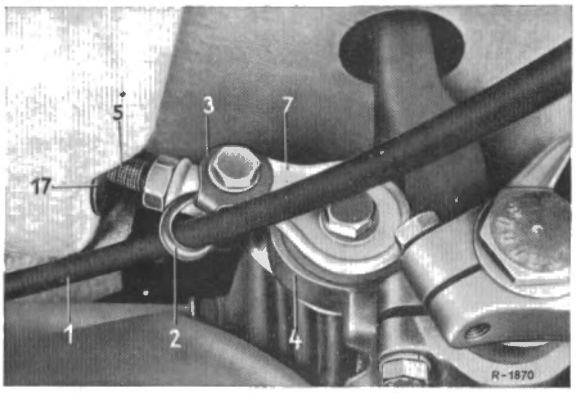


Fig. 35-1a/3

1 Rear brake cable
2 Rubber eyelet
3 Fixing clip
4 Rear suspension support with rubber mounting
5 Cross strut
7 Link
17 Cuff for side support

The outer hexagon screw in the link (7) is not locked by a spring washer; instead the fixing clip (3) which holds the right rear brake cable (1) in position by means of the rubber eyelet serves at the same time as a locking plate (Fig. 35-1a/3).

Rear Axle Shaft

Job No.
35-3

Removal, Repair, Sealing, and Installation

Rear Axle installed

Modification: Models as from August 1965 added

Models 190 c, 190 Dc, 200, 200 D, 220 b, 220 Sb, 220 SEb, 230, 230 S, 230 SL, 300 SE Sedan, 300 SE/C up to Aug. 1965

On cars with air suspension pay attention to "General Instructions for Assembly Work" (see Job No. 32-11).

Removal:

a) Rear Axle with Drum Brake

1. Remove the brake shoes (see Job No. 42-9).
2. Unscrew the pulley housing from the brake anchor plate and remove toward the rear.
3. Disconnect the brake line from the wheel brake cylinder.
4. Unscrew the hexagon screw (22) on the bracket (13) supporting the brake anchor plate and remove together with the lock washer and the washers (21) (Fig. 35-3/1).

Note: Rear axles with light metal brake shoes have no anchor pin (20).

For continuation see para 8!

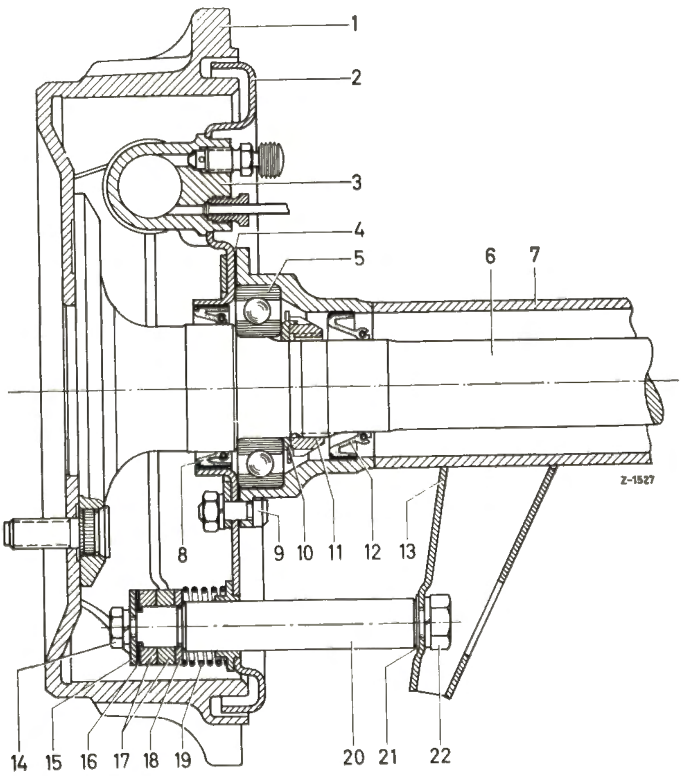


Fig. 35-3/1

1 Brake drum
2 Brake anchor plate
3 Wheel cylinder
4 Seal
5 Annular grooved bearing
6 Rear axle shaft
7 Axle tube
8 Outer seal
9 Fitted screw
10 Locking plate
11 Grooved nut
12 Inner seal
13 Bracket
14 Hexagon screw with lock washer
15 Washer
16 Brass washer
17 Brake shoe
18 Washer
19 Pressure spring
20 Anchor pin
21 Washer
22 Hexagon screw with lock washer

b) Rear Axle with Disk Brake

5. Remove the brake caliper (see Job No. 42-8).

6. Unscrew the hexagon socket screws (43) for fastening the wheel fixing disk (40) and the brake disk (19) (Fig. 35-3/2).

7. Pull the wheel fixing disk and the brake disk off the rear axle shaft.

Note: If the rear axle shaft is only removed in order to replace the seal or the barrel roller bearing, it is advisable to mark the relative position of wheel fixing disk and brake disk to the rear axle shaft.

For continuation see para 8!

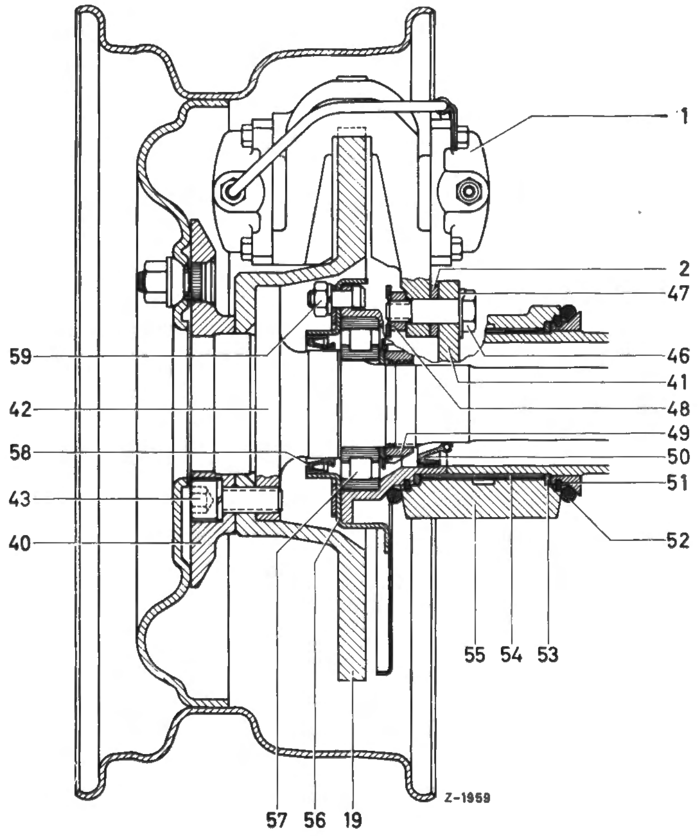


Fig. 35-3/2

1 Brake caliper
2 Shim
19 Brake disk
40 Wheel fixing disk
41 Fixing eye on the bearing housing
42 Rear axle shaft
43 Hexagon socket screw
46 Hexagon fitting screw
47 Locking plate,
48 Bracket
49 Grooved nut with lock
50 Seal
51 Sealing ring
52 Rubber ring
53 Split shim
54 Bearing shell
55 Bearing housing
56 Sealing ring retainer
57 Barrel roller bearing
58 Seal
59 Fitting bolt with hexagon nut and lock washer

8. Unscrew the hexagon nuts of the fitting bolts (9) or (59) for fastening the brake anchor plate (2) or the sealing ring retainer (56) to the axle tube (Figs. 35-3/1 and 35-3/2).

9. Attach Fixture 111 589 12 33 00 (1) to the flange of the rear axle shaft and the axle tube and pull the rear axle shaft off the axle tube by turning the spindle (Fig. 35-3/3).

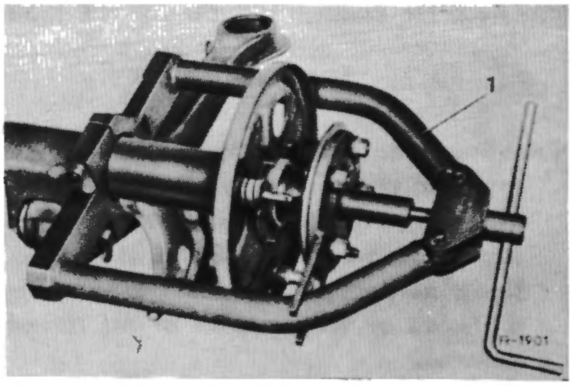


Fig. 35-3/3

Fixture 111 589 12 33 00

Note: Fixture 136 589 18 33 with which the rear axle shaft is removed by a number of blows should no longer be used. There is a danger that too hard blows damage the annular grooved bearing or the barrel roller bearing of the rear axle shaft.

Disassembly:

10. Install the rear axle shaft in Mounting Plate 136 589 05 31 00 and fix it in position with two wheel nuts or screws (Fig. 35-3/4).

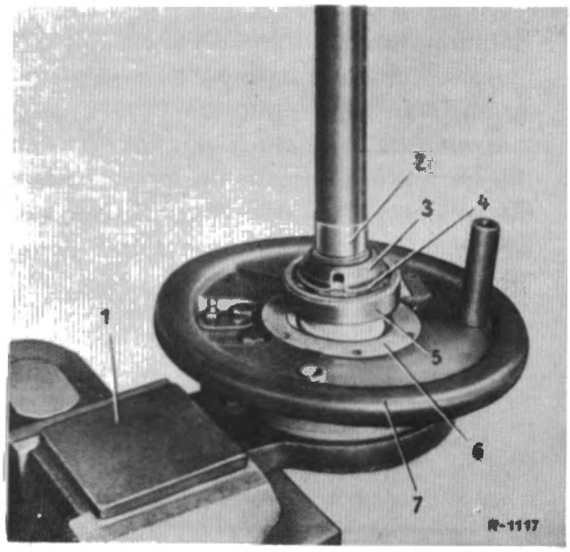


Fig. 35-3/4

1 Mounting plate
2 Rear axle shaft
3 Grooved nut
4 Locking plate
5 Annular grooved bearing
6 Seal
7 Brake anchor plate

On rear axles with disk brake the wheel fixing disk should be attached to the rear axle shaft previously.

11. Tap up the locking plate and use Nose-type Wrench 136 589 09 07 00 to unscrew the grooved nut from the rear axle shaft (Fig. 35-3/5).

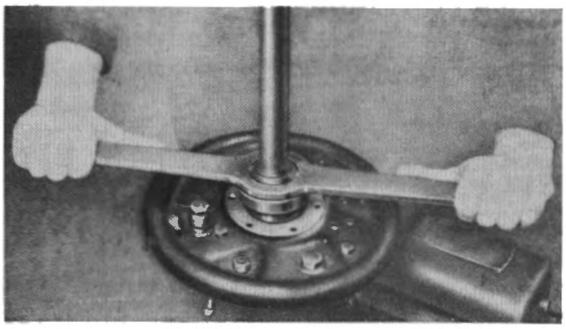


Fig. 35-3/5

12. Use the appropriate puller to pull the annular grooved bearing or barrel roller bearing of the rear axle shaft (Fig. 35-3/6).

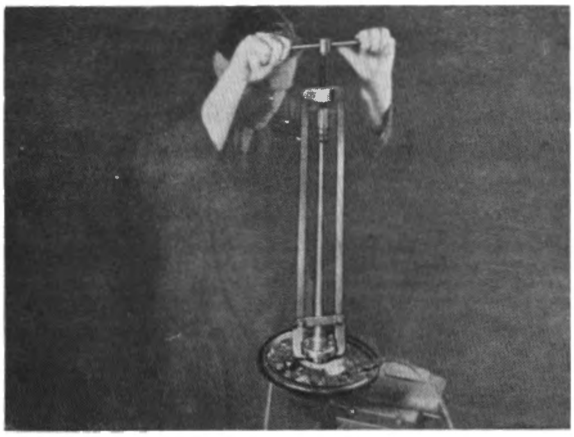


Fig. 35-3/6

The following pullers are required:

136 589 20 33 00
for Models 190 c to 230 SL with malleable cast-iron shoes,

110 589 02 33 00
for Models 190 c to 220 SEb with light-metal brake shoes on rear axle,

112 589 01 33 00
for Model 300 SE.

13. Remove the brake anchor plate or the sealing ring retainer and press out the seal.

Repair:

14. Check the center bore of the rear axle shaft and, if necessary, regrind on a center grinder (Fig. 35-3/7).

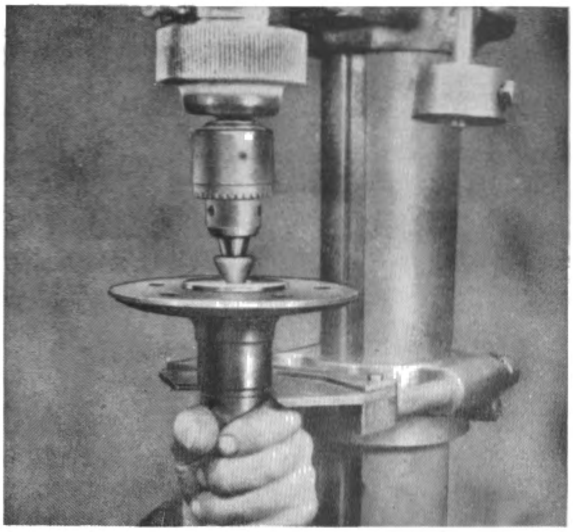


Fig. 35-3/7

15. Check the shaft at the flange, the bearing seat, and the contact surfaces of the seals for true run (Fig. 35-3/8). If necessary, straighten it and re-turn the flange (see Job No. 35-0). In order to re-turn the flange, press out the wheel fixing bolts, and be careful not to damage the brake drum or brake disk recess.

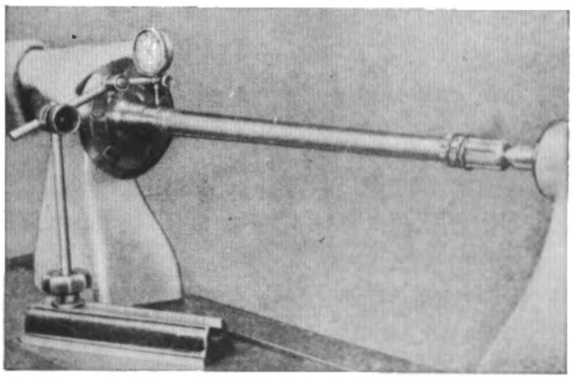


Fig. 35-3/8

16. Check the contact surfaces for the seals. Worn contact surfaces may be reduced (see Job No. 35-0).

Note: The contact surface for the outer seal is provided with an oil return thread which should in any case be checked or re-applied (Fig. 35-3/9 and Job No. 35-0). Under no circumstances must there be any confusion of the direction of the thread-pattern!

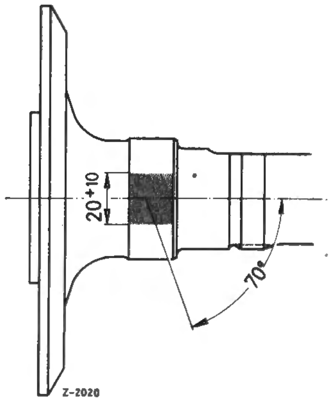


Fig. 35-3/9

Left rear axle shaft with right-hand thread-pattern

17. The thread-pattern is made by means of a flat piece of wood covered by emery cloth (grain No. 180). During the process hold the wood at an angle of approx. 70° and file in the direction of the arrow toward the splines of the shaft (Figs. 35-3/10 and 35-3/11). Turn the shaft as required during the process.

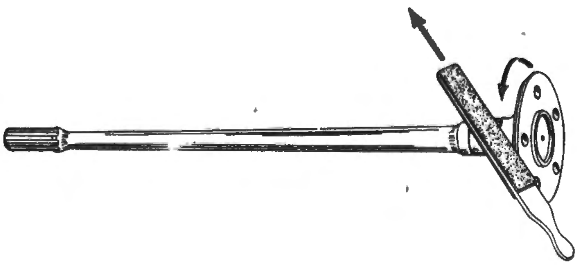


Fig. 35-3/10

Left rear axle shaft with right-hand thread-pattern

Flange of rear axle shaft pointing to tailstock

Note: It is adivisable to place a soft rubber sheet approx. 3 mm thick between the piece of wood and the emery cloth. This produces a more pronounced thread-pattern. Clean the shaft thoroughly before applying the thread-pattern. The surface finish or depth of the thread-pattern should be approx. 0.003 to 0.006 mm. **The grooves must run parallel and must not be interrupted by transverse lines (Fig. 35-3/9).**

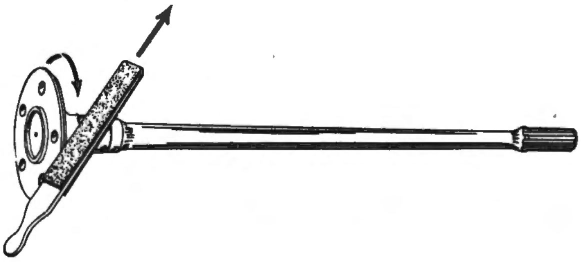


Fig. 35-3/11

Right rear axle shaft with left-hand thread-pattern

Flange of rear axle shaft pointing to headstock

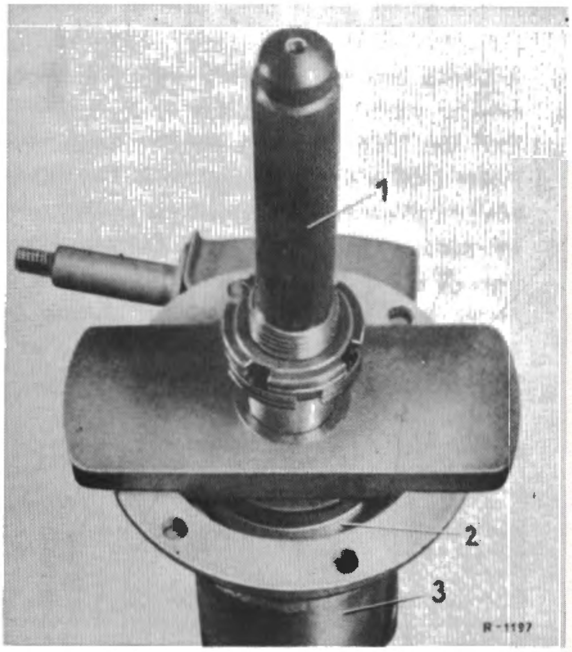


Fig. 35-3/12a

1 Installing Arbor 110 539 01 43 00
2 Seal
3 Axle tube

18. If the wheel fixing bolts were pressed out, press in new wheel fixing bolts and peen them.

Caution: The wheel fixing bolts must make an absolutely tight fit.

19. Check the inner seal in the axle tube. If necessary, press the seal out of the axle tube and use Installing Arbor 110 589 01 43 00 (1) to press a new seal (2) as far as it will go into the axle tube (3) (Figs. 35-3/12 and 35-3/12a).

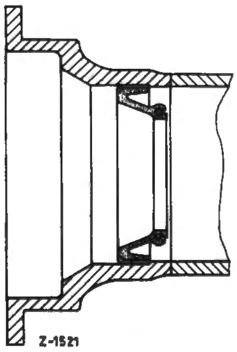


Fig. 35-3/12

20. Coat the circumference of a new outer seal with sealing compound and press it into the brake anchor plate or, with a suitable pad, in the sealing ring retainer by means of Installing Fixture 120 589 05 39 00 (Fig. 35-3/13).

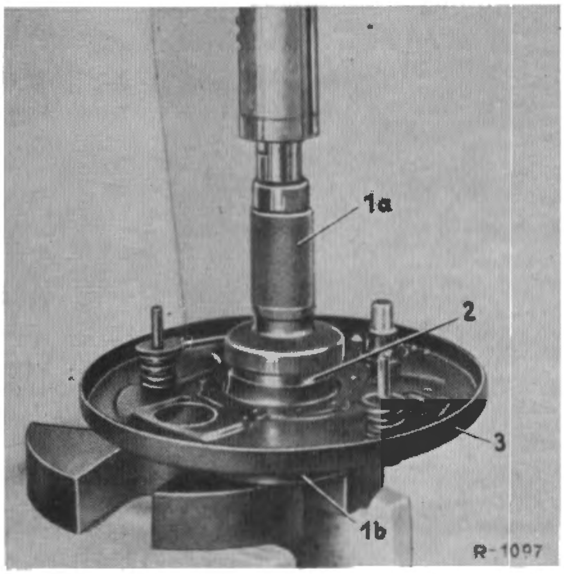


Fig. 35-3/13

Installing Fixture 120 589 05 39 00
1a Installing arbor
1b Guide plate
2 Seal
3 Brake anchor plate

Note: Place the guide plate (1b) of Installing Fixture 120 589 05 39 (only suitable for pressing the sealing ring into the brake anchor plate) in the press in such a way that the face with the smaller outer diameter (108 mm) points upward. The brake anchor plate must be properly seated with its recess in the guide plate. On older models of the installing fixture the outer diameter is 118 mm. Such plates should be subsequently changed in accordance with the dimensions given in Fig. 35-3/13a.

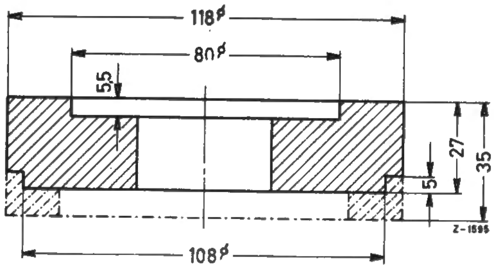


Fig. 35-3/13a

21. Coat the contact surface of the seal on the rear axle shaft with Molykote paste. Carefully push the brake anchor plate or sealing ring retainer onto the shaft. Use Installing Sleeve 120 589 00 61 00 to prevent damage to the seal (Fig. 35-3/14).

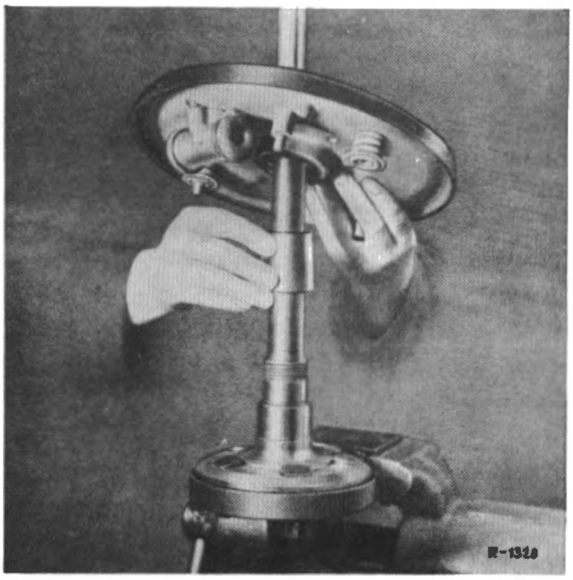


Fig. 35-3/14

Note: There is a difference in the length of the rear axle shaft. The longer shaft should be installed together with the left bake anchor plate and the shorter together with the right brake anchor plate or sealing ring retainer.

22. Press the annular grooved bearing or barrel roller bearing on to the rear axle shaft (Fig. 35-3/15).

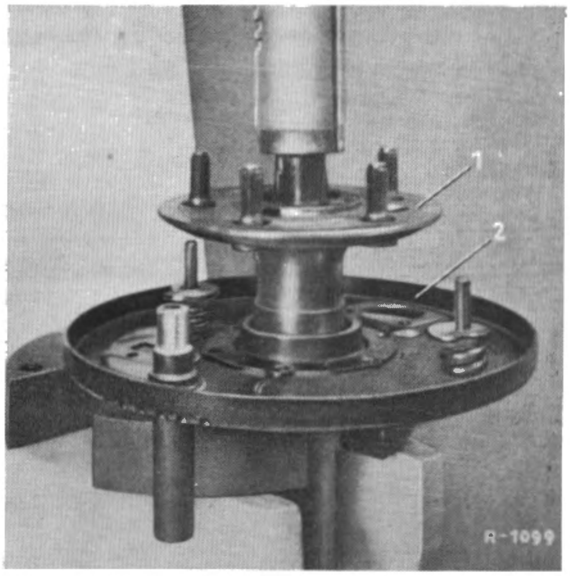


Fig. 35-3/15
1 Rear axle shaft
2 Brake anchor plate

Note: The annular grooved bearing or barrel roller bearing must not be forced on to the shaft in order to prevent damage to the bearing.

23. Install the locking plate with the shoulder against the inner race of the bearing, making sure that the locking plate fits snugly. Tighten the grooved nut hard by means of Nose-type Wrench 136 589 09 07 00 [(Fig. 35-3/5) (for tightening torque see Job No. 35-0)].

24. Peen the locking plate into the grooves of the grooved nut (Fig. 35-3/16).


Fig. 35-3/16

25. Apply sealing compound to both sides of the gasket and place it in position on the brake anchor plate or sealing ring retainer (Fig. 35-3/16).

26. Fill the space between the inner and the outer seal and the mounting of the annular grooved bearing or barrel roller bearing in the axle tube with antifriction bearing grease (Figs. 35-3/1 and 35-3/2).

Installation:

a) Rear axle with drum brakes

Caution:

When on cars with rear axle drum brakes **the rear axle shaft is replaced,** the following details are important: The splines on the right rear axle shaft and on the sliding sleeve have been modified. To prevent confusion during installation the rear axle shafts have been provided with a single or double bead for identification and they have different part numbers (Fig. 35-3/17). The new shaft (double bead) **cannot** be combined with an old sliding sleeve and vice versa. If a single bead shaft is removed from a car, a new single bead shaft must be installed (see also note on page 35-7/1).

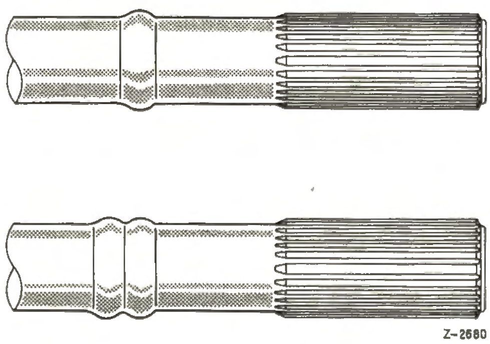
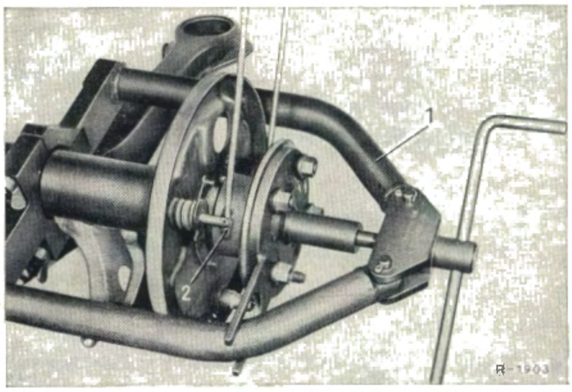


Fig. 35-3/17

27. Press the rear axle shaft into the axle tube by means of Fixture 111 689 12 33 00 (1) (Fig. 35-3/18).

Note: When installing barrel roller insert Fixture 111 589 08 63 00 (2) simultaneously between the brake anchor plate and the flange of the rear axle shaft. This fixes the outer race of the barrel roller bearing in its proper position and considerably facilitates the installation of the bearing (Fig. 35-3/18).



35-3/18

1 Fixture 111 589 12 33 00

2 Fixture 111 589 08 63 00

28. Attach the brake anchor plate to the axle tube by means of 6 nuts and lock washers (for tightening torque see Job No. 35-0).

29. In the case of rear axles with malleable cast iron brake shoes screw hexagon screw (22) on the bracket (13) supporting the brake anchor plate into the anchor pin (20) and tighten, carefully correcting the gap between the pin and the support by means of shims (21) (Fig. 35-3/1). The shims are available in thicknesses of 0.5 and 1.0 mm.

30. Attach the pulley housing to the brake anchor plate.

31. Connect the brake line.

32. Install the brake shoes (see Job No. 42-9).

33. Bleed the brake system.

34. Check the oil level in the rear axle and top up if necessary.

b) Rear axle with disk brakes

35. Press the rear axle shaft into the axle tube by means of Fixture 111 589 12 33 00. At the same time insert Fixture 112 589 08 59 00 between the sealing ring retainer and the flange of the rear axle shaft. As a result the outer race of the barrel roller bearing is fixed in its proper position which considerably facilitates the installation of the bearing (Fig. 35-3/19).

36. Attach the brake anchor plate to the axle tube by means of 6 nuts and lock washers (for tightening torque see Job No. 35-0).

37. Slide the brake disk and the wheel fixing disk on the rear axle shaft, carefully observing any marks previously made.

38. Install and tighten the hexagon socket screws (43) together with lock washers (Fig. 35-3/2. For tightening torque see Job No. 35-0).

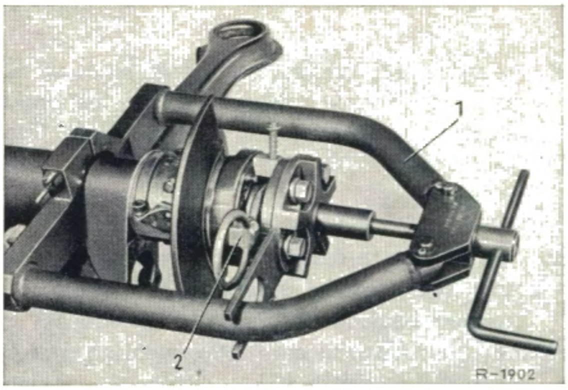


Fig. 35-3/19

1 Fixture 111 589 12 33 00

2 Fixture 111 589 08 63 00

39. Install the brake caliper (see Job No. 42-8).

40. Bleed the brake system.

41. Check the oil level in the rear axle and top up if necessary.

Rear Axle Shaft

Removal, Repair, Sealing and Installation

Rear Axle Installed

Models 250 S, 250 SE, 300 SEb, 300 SE/C as from Aug. 65, 300 SEL

On cars with air suspension pay attention to "General Instructions for Assembly Work" (see Job No. 32-11).

Caution: On the first cars of Models 250 S, 250 SE, 300 SEB and 300 SE/C as from August 1965 the left rear axle shaft had an additional mounting in the differential housing (Fig. 35-3a/1), whereas on later cars the bearing bushing (25) was no longer installed and the rear axle shaft was modified accordingly (Fig. 35-3a/2).

When repairs are carried out the 1st version rear axle shaft can without any difficulty be exchanged for the 2nd version rear axle shaft and the bearing bushing (25) need not be removed from the differential gear housing.

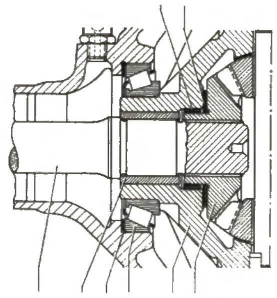


Fig. 35-3a/1
1st version

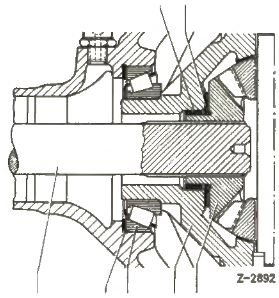
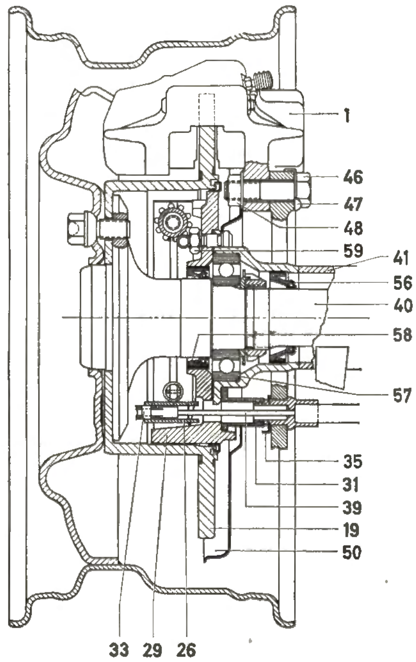


Fig. 35-3a/2
2nd version

21 Differential side gear
22 Differential housing
23 Annular taper roller bearing
24 Compensating washer
25 Bearing bushing
26 Left rear axle shaft
28 Polyamide bearing ring
29 Thrust washer



Removal:

1. Remove the brake caliper (see Job No. 42-7) and take off the brake disk.

2. Remove the brake shoes of the parking brake (see Job No. 42-28).

3. Unscrew the hexagon nuts of the fitting bolts (59) which fasten the back plate (29) to the axle tube (Fig. 35-3a/3).

Fig. 35-3a/3

1 Brake caliper
19 Brake disk
26 Expansion lock
29 Back plate
31 Rubber sleeve
33 Pin for brake cable
35 KL lock for brake cable
39 Brake cable
40 Rear axle shaft
41 Axle tube
46 Hexagon fitting bolt
47 Locking plate
48 Bracket with weld-on nut
50 Cover plate
56 Seal
57 Grooved ball bearing
58 Seal
59 Fitting bolt with hexagon nut and lock washer

35-3a/1

4. Remove the fitting bolts from the axle tube and take off the cover plate (50) (Fig. 35-3a/3).

5. Attach Fixture 111 589 12 33 00 to the flange of the rear axle shaft and to the axle tube and pull the rear axle shaft out of the axle tube (Fig. 35-3a/4).

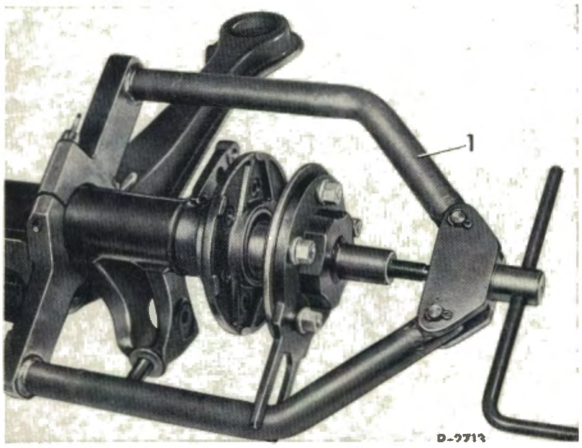


Fig. 35-3a/4

1 Fixture 111 589 12 33 00

Disassembly:

6. Install the rear axle shaft in Mounting Plate 136 589 05 31 00. Unlock the grooved nut and unscrew it from the rear axle shaft by means of Nose-type Wrench 136 589 09 07 00 (Fig. 35-3a/5).

Fig. 35-3a/5

1 Nose-type Wrench 136 589 09 07 00

7. Pull off the grooved ball bearing or barrel roller bearing by means of Puller 136 589 20 33 00 (Fig. 35-3a/6).

8. Take off the back plate and press out the seal.

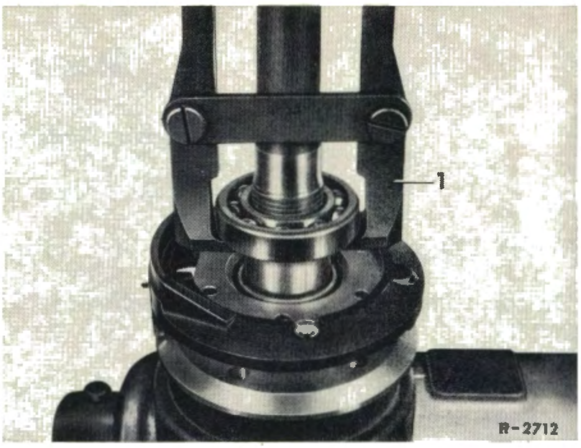


Fig. 35-3a/6

1 Puller 136 589 20 33 00

Repair:

9. See Job No. 35-3, Paras. 14–19.

10. Coat the circumference of a new seal (58) with sealing compound and press it into the back plate (29) in such a way that it is flush with the outer rim (Figs. 35-3a/3 and 7).

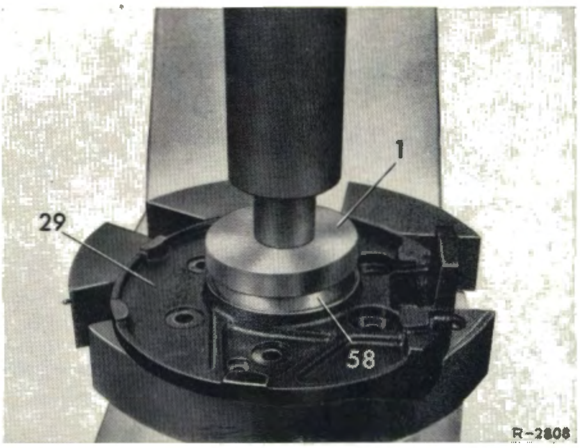


Fig. 35-3a/7

1 Pressure plate
29 Back plate
58 Seal

11. Coat the contact surface for the seal on the rear axle shaft with molybdenum disulfide paste (e. g. Molykote Paste or LM KFZ 4). Put Installing Sleeve 120 589 00 61 00 (1) on the rear axle shaft and carefully slide on the back plate (2) (Fig. 35-3a/8).

12. Press the grooved ball bearing or barrel roller bearing onto the rear axle shaft (Fig. 35-3a/9).

13. Place the shoulder of the locking plate against the inner race of the bearing, taking care to ensure that the locking plate is properly positioned. Use Nose-type Wrench 136 589 09 07 00 to tighten the grooved nut

and lock it (Fig. 35-3a/10). For tightening torque (see Job No. 35-0).

Fig. 35-3a/8

1 Installing Sleeve 120 589 00 61 00
2 Back plate

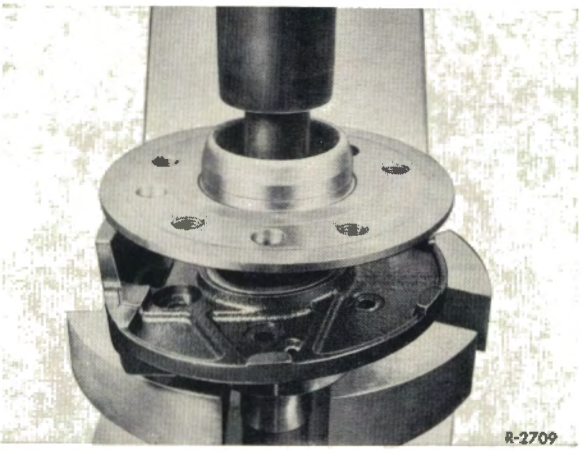


Fig. 35-3a/9

Fig. 35-3a/10

14. Coat the gasket with sealing compound and place it on the back plate.

15. Fill the space between the inner and outer seal and the mounting of the grooved ball bearing or barrel roller bearing in the axle tube with anti-friction bearing grease (Fig. 35-3a/3).

Installation:

16. Press the rear axle shaft into the axle tube by means of Fixture 111 589 12 33 00 (1) (Fig. 35-3a/11).

Note: When installing barrel roller bearings insert Fixture 111 589 08 63 00 (2) between back plate and flange of the rear axle shaft. The fixture fixes the outer race of the barrel roller bearing in its proper position and thus considerably facilitates the installation of the bearing (Fig. 35-3a/11).

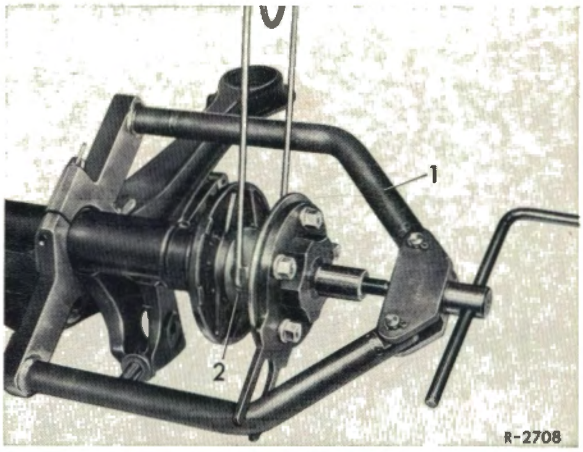


Fig. 35-3a/11

1 Fixture 111 589 12 33 00
2 Fixture 111 589 08 63 00

17. Attach the cover plate (50) to the axle tube by means of the fixing bolts (59) and screw the back plate (29) to the axle tube (Fig. 35-3a/3). For tightening torque see Job No. 35-0.

18. Install the brake shoes of the parking brake (see Job No. 42-28).

19. Insert the brake disk and attach the brake caliper (see Job No. 42-7).

Note: Before installation **lightly** coat the recess of the brake disk with Molykote Paste "U" or with LM 36 in order to facilitate removal of the brake disk from the rear axle shaft whenever this should become necessary.

20. Bleed the brake system (see Job. No. 42-23).

21. Check the oil level in the rear axle with the axle tubes in the horizontal position and if necessary top up.

Note: Make sure that the rear axle is filled with the proper grade of oil. Use only special oil for rear axles with locking differential.

Job No.
35-8

Replacing Drive Pinion Seal

Rear Axle Installed

Modification: Completely Revised

In the case of cars with air suspension pay attention to "General Instructions for Assembly Work" (see Job No. 32-11).

When repairs are necessary, the drive pinion seal can be replaced the rear axle installed in the car. The job must be carried out with the utmost care in order to prevent damage to the bearings or uneven running of the system.

REMOVAL:

1. Drain the oil from the rear axle.

2. Jack up the car at the rear, remove wheels and brake drums and put the axle tubes in a horizontal position.

NOTE: It is sufficient for the purpose to jack up the car at the rear under the rear axle tubes and put a suitable load in the trunk compartment. If this is done the compensating spring need not be removed.

3. Detach the propeller shaft at the joint flange of the drive pinion (see Job No. 41-1).

4. Mark the position of the joint flange in relation to the drive pinion by two center punch marks in order to ensure that on reassembly the joint flange is installed in exacly the same position as before (Fig. 35-8/6).

5. Unlock the grooved nut and unscrew by means of Special Wrench 111 589 00 07 00 (2), holding the joint flange (4) steady with Retaining Wrench 111 589 02 07 00 (3) (Fig. 35-8/4).

6. Use a suitable fixture to pull the joint flange off the drive pinion.

7. Check the contact surface for the seal on the joint flange. If the contact surface is worn replace the joint flange. In an emergency the contact surface can be remachined (for dimensions see Job No. 35-0).

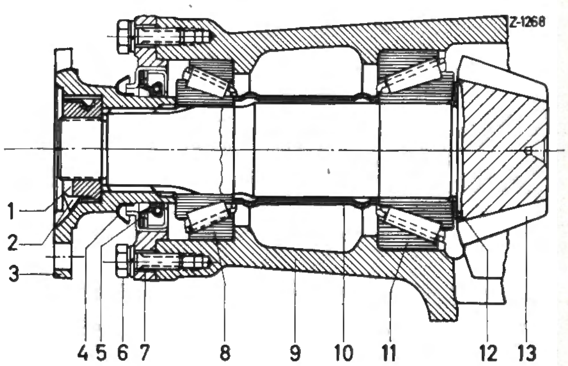


Fig. 35-8/1

1 Grooved nut
2 Locking plate
3 Joint flange
4 Protective washer
5 Seal
6 Hexagon screw
7 Cover
8 Front annular taper roller bearing
9 Rear axle housing
10 Spacer sleeve
11 Rear annular taper roller bearing
12 Compensating washer
13 Drive pinion

After remachining the contact surface apply an oil return thread (left-hand-thread) in accordance with the dimensions shown in Fig. 35-8/3. This should be done by means of a suitable piece of wood covered by emery cloth (grain Nr. 180), holding the wood at an angle of approx. 45°. **The grooves should be strictly parallel and should on no account be crossed by transverse lines.**

Note: If any lathe work is done on the joint flange clamp the drive pinion together with the flange between two centers.

8. Press the seal (5) out of the cover (7) of the rear axle housing (Fig. 35-8/1).

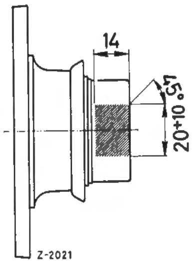


Fig. 35-8/3

Installation:

9. Coat the circumference of a new seal (5) with sealing compound and press it into the cover (7) of the rear axle housing (Fig. 35-8/1).

10. Coat the contact surface of the joint flange for the seal with Molykote paste and push the flange onto the drive pinion, paying attention to the marks made during disassembly.

11. Attach Retaining Wrench 111 589 02 07 00 (3) to the joint flange. Screw on the grooved nut with the locking plate and carefully tighten with Special Wrench 111 589 00 07 00 (2) until the described torque (see Job No. 35-0) is reached when the whole axle drive is turned (Fig. 35-8/4).

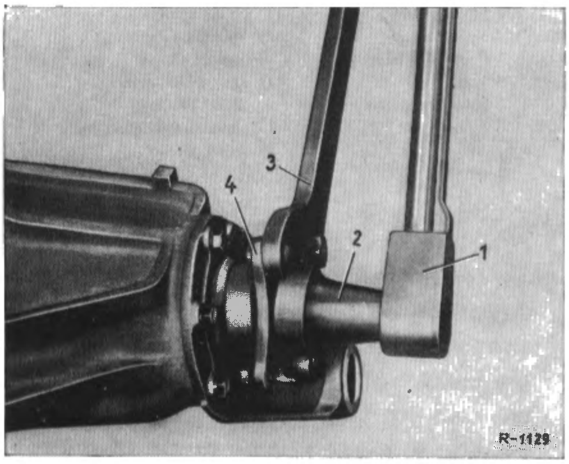


Fig. 35-8/4

1 Flexible torque wrench
2 Special Wrench 111 589 00 07 00
3 Retaining Wrench 111 589 02 07 00
4 Joint flange

12. In order to check the friction value of the bearings put Torque Wrench 000 589 87 21 00 on top of Special Wrench 111 589 00 07 00 and turn the drive pinion (Fig. 35-8/5).

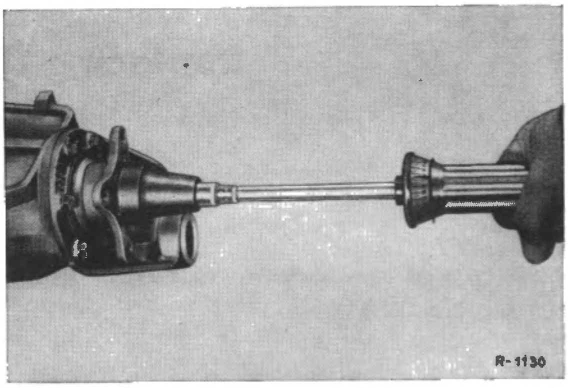


Fig. 35-8/5

Note: This check can give adequate results only if the axle tubes are in a horizontal position and the brake drums have been removed. If the torque is higher than the prescribed value the drive pinion must be removed and a **new** spacer sleeve installed. On no account must the torque be decreased by loosening the grooved nut, which would forfeit the initial tension of the annular taper roller bearings and result in rear axle noises.

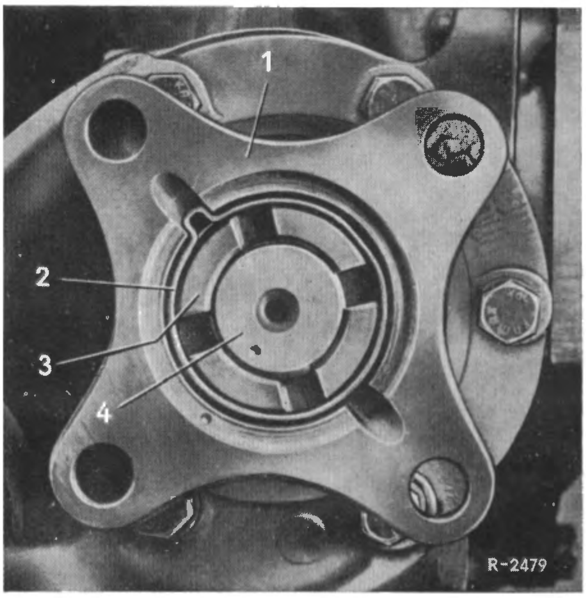


Fig. 35-8/6

1 Joint flange
2 Locking plate
3 Grooved nut
4 Drive pinion

13. Lock the grooved nut (3) on the joint flange (1) (Fig. 35-8/6).

14. Connect the propeller shaft flange (see Job No. 41-1).

15. Fill up the rear axle with oil (for amount of oil see Job No. 35-0).

Replacement of Rear Axle Cuff between Rear Axle Housing and Right Axle Tube

Job No.
35-9

Rear axle installed

*Modification: marked**

In the case of cars with air suspension pay attention to "General Instructions for Assembly Work" (see Job No. 32-11).

Note: When replacing the rear axle cuff, it is no longer necessary to remove the right axle tube. For repair purposes a split rear axle cuff is now available.
If during repairs the rear axle is being removed and disassembled, the previous type one-piece rear axle cuff should be installed.

Removal:

1. Drain the oil off the rear axle.
2. Remove the compensating spring on the rear axle (see Job No. 32-7).
3. **Thoroughly clean** the rear axle housing and the right axle tube in the vicinity of the rear axle cuff.
4. Detach the two hose clamps, cut the rear axle cuff, and remove.
5. **Carefully clean** the contact surface of the cuff on the rear axle housing and the right axle tube.
6. Either lift or lower the car until the axle tubes are horizontal.

Installation:

7. Use Special Pliers 111 589 06 37 00 to compress two clips (auxiliary clips) in such a way that the clip ends are bent to an angle of approx. 45° (Fig. 35-9/1).

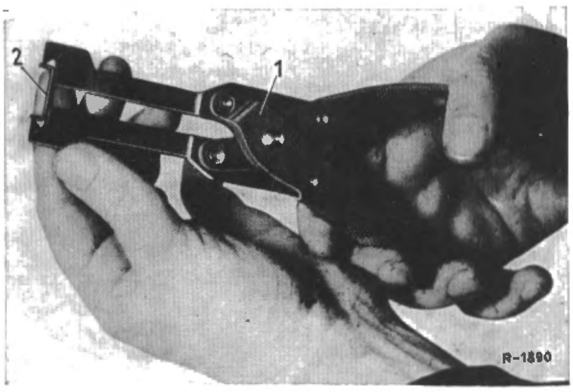


Fig. 35-9/1

1 Special Pliers 111 589 06 37 00   2 Clip

8. Put on the split rear axle cuff and, at the seats for the hose clamps, install one auxiliary clip each, which are intended to hold the cuff together. Slide the cuff onto the rear axle housing and the right axle tube (Fig. 35-9/2).

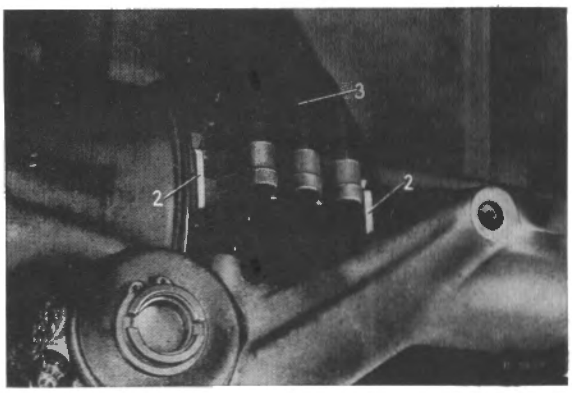


Fig. 35-9/2

2 Auxiliary clip
3 Split rear axle cuff

Note: The cuff seam must be horizontal pointing toward the rear and **must not be coated with sealing compound**

9. Install the spring of the lower bead properly into the groove of the upper bead of the cuff and install two hose clamps. Do not remove the auxiliary clips from their position underneath the hose clamps.

Caution: The hose clamp on the rear axle housing must be installed in such a way that the lock points toward the rear and can be tightened through the fork of the right axle tube. If the lock points toward the top, the movement of the right axle tube might damage the rear axle cuff. The lock of the hose clamp in the right axle tube may point upward (Fig. 35-9/4).

10. Use Special Pliers 111 589 06 37 00 to install one clip each — a total of seven — on each fold circumference and each fold base of the cuff (Figs. 35-9/3 and 35-9/4).

11. Install the compensating spring on the rear axle (see Job No. 32-7).

12. Fill the rear axle with oil.

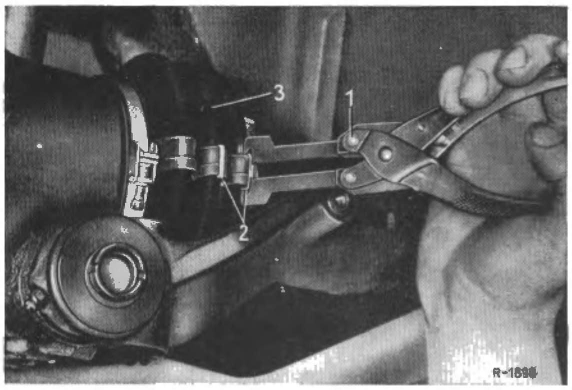


Fig. 35-9/3

1 Special Pliers 111 589 06 37 00
2 Clips
3 Split rear axle cuff

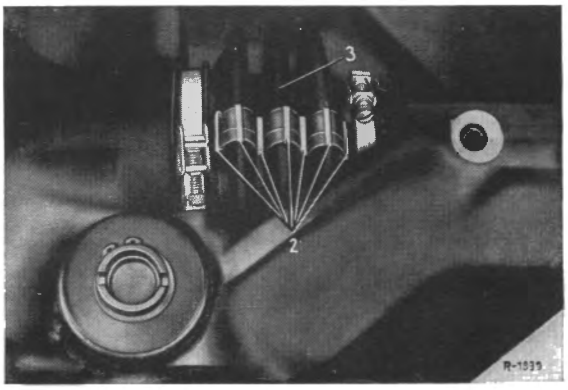


Fig. 35-9/4

2 Clips
3 Split rear axle cuff

13. Make a trial run and check the rear axle cuff for leaks.

Note: It is possible that **insignificant** amounts of oil leak through the seams of the split rear axle cuff.

If, however, there is any major loss of oil, this is due to faulty assembly and the cuff has to be re-installed.

Wheels and Adjustment of Wheels — Group 40

Job No.
40-0

Wheels and Adjustment of Wheels

General Data, Dimensions, and Tolerances

*Modification marked**

A. Wheels

Balancing of Wheels

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL

Available balancing weights weight in g	Stages in g	Permissible unbalance in g
from 20 to 120	from 10 to 10	20

Tightening Torques

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL

Spherical collar nuts and spherical collar screws for disk wheel attachment	9—10 mkg

B. Adjustment

Wheel Adjustment Values under Test Load[1])

Model		190 c 190 Dc	220 b / 220 Sb / 220 SEb Sedan with front axle 1st version	220 b / 220 Sb / 220 SEb Sedan with front axle 2nd version	220 SEb/C	230 SL	300 SE
Camber of front wheels		+ 0° 30' ± 10'				0° + 20'*	+ 0° 30' ± 10'
Toe-in (rolled average)		2±1 mm or 0° 20'±10' 2)					
Track angularity at 20° lock of inner wheel		appr. 0°	appr. —2°30'	appr. 0°			
Caster		3° 30'±15'	2° 45'±15'	2° 45'±15'3)	3° 30'±15'3)	3° 15' ±15'3)	4°±15'
King pin inclination		5° 30'±10'					
Control arm position of front axle. Difference in leval "a" between inner and outer pivot pins of lower control arm (see Fig. 40-3/15)	For normal road conditions	57 ± 15 * mm			53±10* mm	44^{+10}_{-5}	4)
	For bad road conditions	70 ± 10 * mm			65±10* mm		
Permissible tolerance of control arm position between left and right		5 mm					
Pivot point distance (check distance "e" between axis of pivot pin for lower control arm and the ball pin lower edge at the steering arm and at the steering relay arm by means of fixture 111 589 12 21 00 (see Fig. 40-3/8b). During the checking process the notch in the fixture slide should move within the tolerance range (steering gear arm or steering relay arm moved to center control arm pivot).		$4{,}5^{+1}_{-3}$ mm	—	$4{,}5^{+1}_{-3}$ mm			
Pivot point distance (checking by means of measuring bolt). Difference in level "a" between the axis of the pivot point for the lower control arm and the measuring pin at the steering gear arm and steering relay arm (see Fig. 40-3/8 or 40-3/8a) or steering in the straight-ahead position)		49^{+1}_{-3} mm	0±2 mm	49^{+1}_{-3} mm			
Permissible difference in level of the pivot point distance between steering gear arm and steering relay arm		2 mm					
Axle positioning distance, permissible difference left and right	front axle	5 mm					
	rear axle	3 mm					
Camber of rear wheels *		see table "camber of rear wheels"					4)
Permissible toe-in (+) and toe-out (—) of rear wheels		±2 mm or ±0° 20'					
Distance of fulcrum of rear axle tubes from car center		36 mm					
Permissible deviation of rear axle from center position		2 mm					
Permissible wheelbase difference left and right		8 mm					

*1) These values also apply to general service checks.
2) Optimal toe-in 2 mm or 0° 20'.
3) On cars with power steering caster 4°±15'.
*4) See Table "Car Level Adjustment and Test Values on Cars with Air Suspension".

Test Load for Vehicle Measurement (Car in curb condition + Load)[1])*

Model	Load
190 c, 190 Dc, 220 b 220 Sb, 220 SEb, 190 c, 190 Dc Station Wagon	2 × 65 kg on front seats 1 × 65 kg on rear bench
190 c, 190 D Ambulance	2 × 65 kg on front seats 1 × 65 kg on stretcher
230 SL	2 × 75 kg on front seats 1 × 40 kg in the trunk compartment

Note: On Model 300 SE with air suspension no test load is required.

[1]) (Curb condition = car in working order, with oil and water plus full fuel tank plus spare wheel plus tool kit.) If the fuel tank is not full, weight must be put in the trunk compartment (1 liter fuel = 0.75 kg).

Camber of Rear Wheels *

Model		Car Load					
		curb condition[2])			test load[3])		
		rear axle pressure approx. kg	rear wheel camber for normal road conditions	rear wheel camber for bad road conditions	rear axle pressure[1]) approx. kg	rear wheel camber for normal road conditions	rear wheel camber for bad road conditions
190 c		620			735		
190 Dc		630			745		
220 b		635[4])	+ 1° 30' ± 30'	+ 2° 15' ± 30'	750	— 0° 45' ± 30'	+ 0° 30' ± 30'
220 Sb		645			760		
220 SEb Sedan		655			770		
220 SEb	Coupé	680	+ 1° ± 30'	+ 1° 45' ± 30'	795	— 1° 15' ± 30'	0° ± 30'
	Convertible	730			845		
230 SL		600[5])	+ 1° 45' ± 30'		740[5])	— 1° 45' ± 30'	
Police radio cars[6])	190 c	740			855		
	190 Dc	750			845		
	220 b	755	+ 1° 30' ± 30'		870	— 0° 45' ± 30'	
	220 Sb	765			880		
	220 SEb	755			890		
190 c, 190 Dc Station wagon		750	+ 2° ± 30'		870	+ 1° ± 30'	
190 c, 190 Dc Ambulances		890			1010	+ 0° 15' ± 30'	

[1]) On cars with steel sliding roof the rear axle pressure increases by approx. 10 kg and with trailer attachment by approx. 20 kg.

[2]) Camber values for cars in curb condition only apply as a check value for servicing. If a correction of the rear wheel camber is necessary, the car must first be measured under test load.

[3]) If under test load the rear axle pressure (for values see Table "Test Load") is considerably higher than indicated here, adjust the rear springs until the cambervalues given in the table are achieved.

[4]) Applies to 65 liter fuel tank; with 52 liter fuel tank (1st version) the rear axle pressure is lower by approx. 15 kg.

[5]) Car with roadster top; with additional coupé top the rear axle pressure is approx. 25 kg higher.

[6]) On police radio cars the trunk compartment carries a constant load of approx. 100 kg.

Car level adjustment and test values on cars with air suspension[1])*

Model 300 SE

	Adjustment of values[2]	Test values[3]
Control arm position of front axle (difference in level "a")	57 ± 2 mm	57 ± 10 mm
Rear wheel camber	— 0° 45' ± 15'	— 0° 45' ± 1°

[1]) On cars with air suspension, the car level in curb condition is adjusted by setting the connecting rods on the level adjustment valves (one each left and right on the front axle and in the center of the rear axle (see Job No. 40-5).

[2]) Actuate the level adjustment valves by hand until the prescribed level values are obtained.

[3]) The tolerance difference between the adjustment values and the test values is explained by the free travel of the level adjustment valves. The values obtained by manual operation of the level adjustment valves will only be maintained while driving the car.

Camber Adjustment of Front Wheels

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL

Eccentric adjustment at steering knuckle		Camber adjustment on pivot pin of upper control arm by means of shims	
Eccentric adjustment range	Alteration in wheel camber	Shim thickness	Camber alteration on wheel by 1 shim
± 2.5 mm	appr. ± 0° 35'	1.0 mm	appr. ± 0° 15'
		2.0 mm	appr. ± 0° 30'

Camber Adjustment of Rear Wheels

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL

Variation in wheel camber by turning the spring plate one notch (2 mm)	appr. 0° 10'
Change of camber on the wheel when lower or higher upper rubber mounting is installed (6 mm)	appr. 0° 30'

Caster Adjustment

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL

Caster adjustment at steering knuckle		Front axle version	Caster adjustment through eccentric bolt on flat spring supporting front axle support	
Permissible adjustment of threaded bushing to either side	Caster alteration on wheel		Adjustment on flat spring by 1 mm alters caster on wheel by	Overall adjustment range of eccentric bolt
1.5 mm	approx. ± 0° 20'	1.[1])	approx. 0° 15'	± 1° 30'
		2.[2])	approx. 0° 10'	+ 1° 30' to — 0° 30'

[1]) Longitudinal support on top [2]) Longitudinal support downward

Change of control arm position at front axle

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL

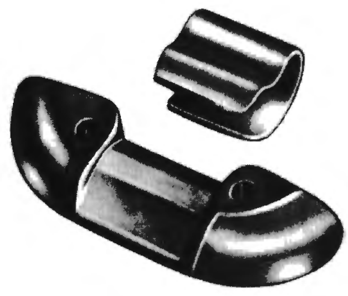
Change of difference in level "a" (see Fig. 40-3/15)	
Change of rubber washer or rubber mounting for front spring by	results in a change of difference in level "a" of
2 mm	appr. 4 mm
2,5 mm	appr. 5 mm

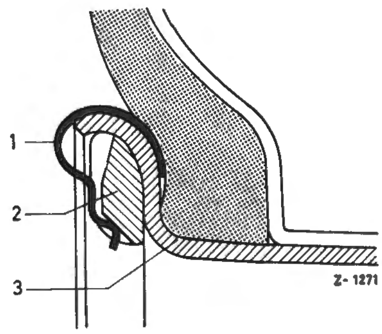
Balancing of Wheels

Job No.
40-2

a) General

The new two-part balancing weights consist of the balancing weight proper (2) and a special retaining spring (1) (Fig. 40-2/1).





R-973

Fig. 40-2/1

1 Retaining spring
2 Balancing weight
3 Rim of disk wheel

The retaining spring is first attached to the wheel flange and the balancing weight is then inserted in the retaining spring. The subsequent insertion of the balancing weight increases the clamping action of the retaining spring to such an extent that the balancing weight is held with absolute safety. The retaining spring cannot be pushed out by the kneading action of the tire since it is very deeply supported in the balancing weight and for that reason the clamping action greatly increases when it is pushed out.
These new balancing weights remain just as firmly in position as the previous types which were fastened in the slots of the rims. For this reason the new disk wheels have no slots. Direct balancing is now possible, so that the mathematical resolution of the established unbalance into the two components relating to two slots is no longer necessary. The new balancing weights can also be used for the older types of slotted disk wheels. In this case care should be taken that the balancing weight is not fitted directly over a slot because in this case the retaining spring will not produce the necessary clamping action. The remaining unbalance in this case is of no practical significance. **Before the wheels are balanced all balancing weights already on the wheels must always be removed.**

b) Installation Instructions

Install the retaining spring by hand, pressing the bead away from the wheel flange with the fixture attached to the balancing machine (Fig. 40-2/2).

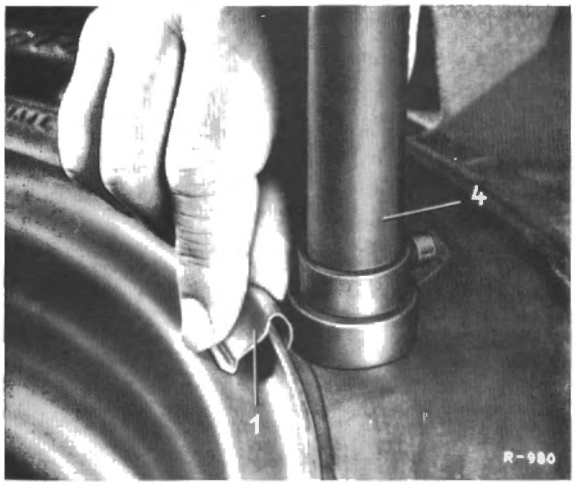


Fig. 40-2/2

1 Retaining spring
4 Fixture on the balancing machine

Then lift the retaining spring by means of Spring Lifter 111 589 15 63 and insert the balancing weight (Fig. 40-2/3), making sure that the retaining spring exerts sufficient pressure on the balancing weight against the wheel flange. If a retaining spring is slightly bent, it can be reshaped by compressing it; **if it is badly bent, it should always be replaced.**

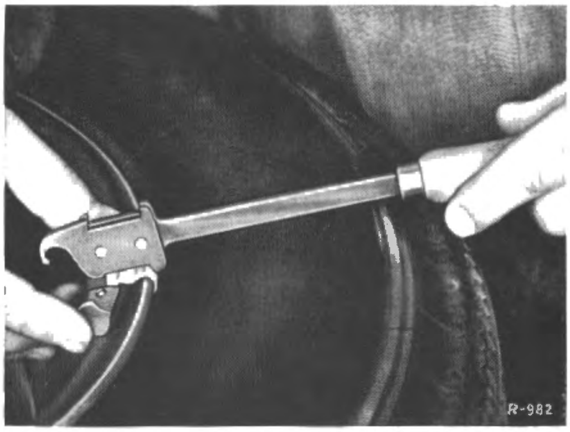


Fig. 40-2/3

Spring Lifter 111 589 15 63

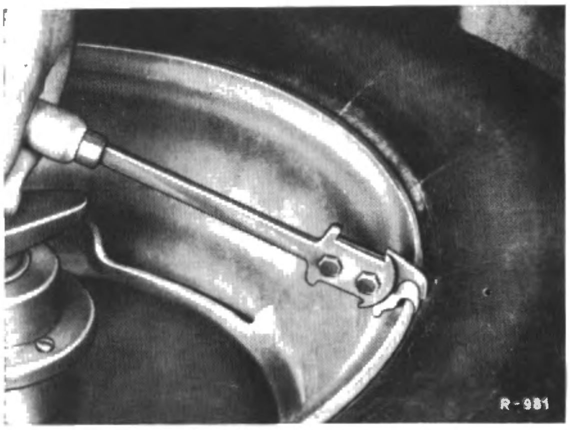


Fig. 40-2/4

To remove the balancing weight, lift the retaining spring by means of the spring lifter.
Then pull the retaining spring off the wheel flange by means of the spring lifter. To do this, insert the lug at the front part of the spring lifter into the bore in the retaining spring (Fig. 40-2/4). During this operation, the tire bead need not be pushed away. It is not advisable to remove the balancing weight together with the retaining spring since this would bend the spring.

<table><tr><td>Job No.</td></tr><tr><td>40-3</td></tr></table>

Adjustment of Wheels

Modification: 2nd Version Front Axle (Addition)

Previous regulations and instructions continue to apply to the general section of this chapter. The car should be tested only when carrying the so-called test load, that is to say the load which corresponds most closely to the position of the car in relation to the surface of the road and to the normal load of the car. The load values and the adjustment data are given Job No. 40-0.

A. Front Wheel Camber

The front wheel camber is adjusted at the steering knuckle by turning the eccentric bolt (1) (Fig. 40-3/1). To do this, back out the hexagon screw (2) and remove together with the locking plate (3). After the hexagon nut has been unscrewed, the camber can be adjusted to the prescribed value by turning the eccentric bolt to the left or to the right. The highest point of the eccentric bolt is marked by a notch on the hexagon head.

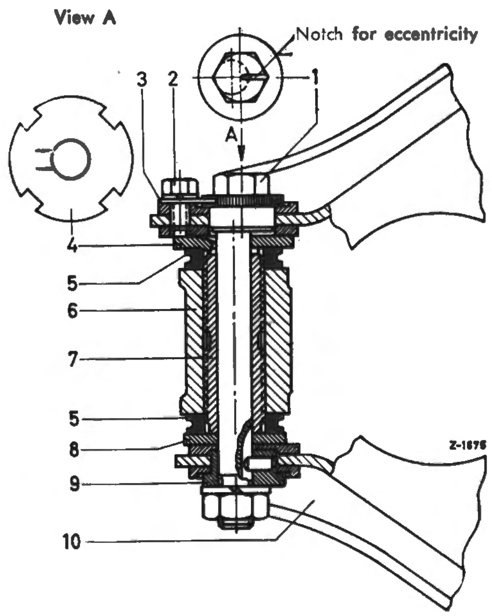


Fig. 40-3/1

1 Eccentric bolt for camber adjustment
2 Hexagon screw with lock washer
3 Locking plate
4 Adjusting washer for caster adjustment
5 Rubber sealing ring
6 King pin
7 Threaded bolt
8 Washer
9 Eccentric bushing with drive pin
10 Upper control arm

If in special cases the camber adjustment at the steering knuckle is not sufficient to achieve the prescribed values at the left and right side, the camber can be changed by installing or removing shims (3) between the pivot pin (6) for the upper control arm (2) and the front axle support (7) (Fig. 40-3/2).

In the case of the 1st version front axle a shim 1 mm thick is normally inserted between the front axle support and the pivot pin and between the locking plate and the hexagon screw (Fig. 40-3/2). In the case of the 2nd version front axle a shim 2 mm thick is normally inserted between the front axle support and the pivot pin (Fig. 40-3/2a).

Note: a) If a shim between the front axle support and the pivot pin is removed, it must be inserted between the locking plate and the hexagon screw.

In any case shims with a total thickness of at least 2 mm must be used. The shims should under no circumstances be omitted since there is a danger that the screw will foul the front spring.

b) After tightening (for prescribed tightening torque see Job No. 33-0), the hexagon screws should be locked. When repairs are carried out, the locking plate should be installed in such a way that the lug can be tapped down at the top of the screw head and not at the bottom, as shown in the picture.

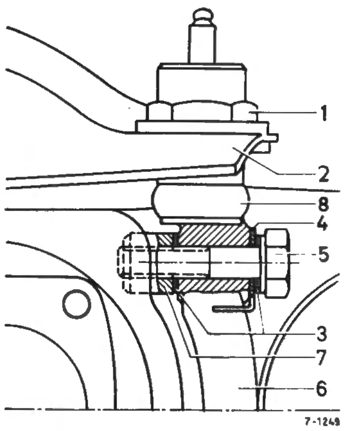


Fig. 40-3/2

1st version front axle

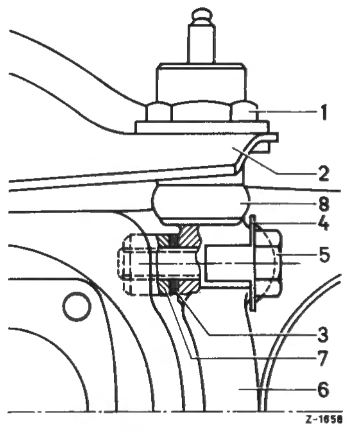


Fig. 40-3/2a

2nd version front axle

1 Threaded bushing for upper control arm
2 Upper control arm
3 Shim
4 Locking plate
5 Hexagon screw (M 12×1.5×40)
6 Pivot pin for lower control arm
7 Front axle support
8 Rubber sealing ring

B. Rear Wheel Camber

The rear wheel camber is adjusted by turning the lower spring plate (5) and by installing upper rubber mountings (2) of varying thickness. (Fig. 40-3/3).

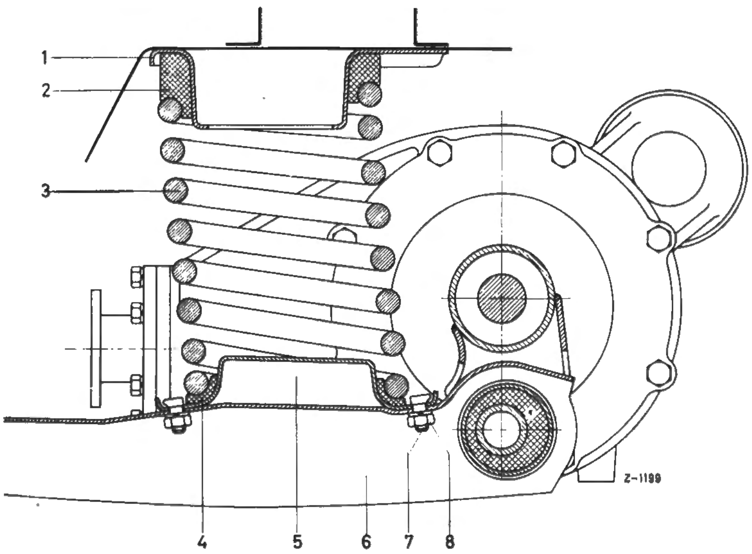


Fig. 40-3/3

1 Upper spring plate on chassis base panel
2 Upper rubber mounting
3 Rear spring
4 Lower rubber mounting
5 Lower spring plate
6 Torque arm
7 Screw for fastening the spring plate to the torque arm
8 Hexagon nuts with lock washers

At the same time the differences in the installed lengths of the rear springs can be compensated by varying the position of the spring plate and by using rubber mountings of different thicknesses. Three different positions of the spring plate and rubber mountings of three different thicknesses are available (see Job No. 32-0 and Job No. 32-5).

To adjust the rear wheel camber remove the rear spring (see Job No. 32-5). Then unscrew the lower spring plate from the torque arm and adjust accordingly or use a new upper rubber mounting (see table in Job No. 32-0).

Note: If in special cases the camber adjustment at the rear spring by changing the notch position of the lower spring plate and by changing the upper rubber mounting is not sufficient, the camber can be further adjusted by changing the rubber rings for the compensating spring. It should be noted however, that this has an influence on the camber of both rear wheels (see Job No. 32-0).

C. Caster

The caster can be adjusted by swivelling the front axle support on the eccentric bolts at the flat springs for the front axle longitudinal support (Figs. 40-3/4 and 4a). Differences in the caster between the left and right sides can be compensated by turning the threaded bolt (7) on top of the steering knuckle (Fig. 40-3/5).

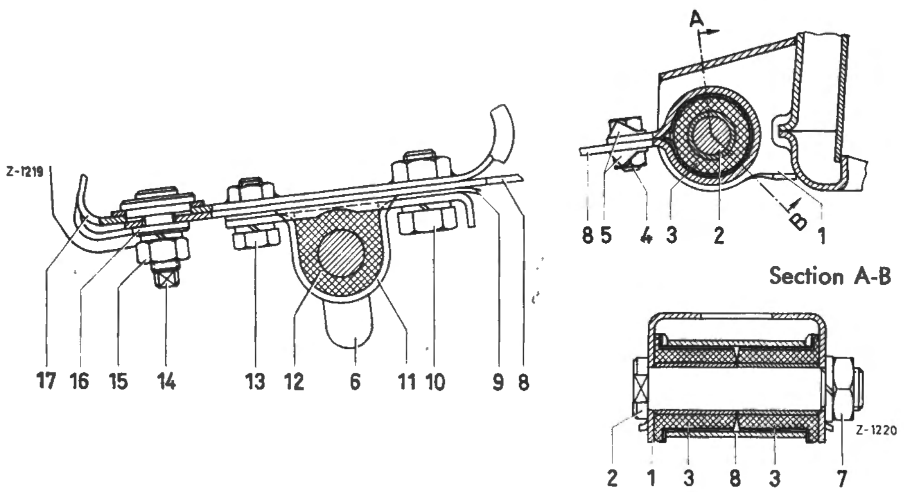


Fig. 40-3/4

Longitudinal support of 1st version front axle

1 Bearing bracket on front axle support
2 Bolt
3 Rubber mounting for flat spring
4 Hexagon screw with nut
5 Locking plate
6 Torsion bar
7 Hexagon nut with lock washer
8 Flat spring
9 Locking plate
10 Hexagon screw (M 14×1.5×25) with lock washer
11 Bracket for rubber mounting
12 Rubber mounting for torsion bar
13 Hexagon screw (M 12×1.5×25) with lock washer
14 Eccentric bolt
15 Hexagon nut with lock washer
16 Washer
17 Chassis base panel
18 Spacer ring
19 Spacer tube

In this way the caster can only be adjusted evenly on both sides. **A more extensive unilateral adjustment whould put too much stress on the flexible suspension parts and this must be avoided at all costs,** since a smooth running of the wheels depends on a tension-free suspended front axle.

Before adjusting the caster by means of the eccentric bolt at the flat spring, loosen the four hexagon screws fastening the support of the rear engine suspension. This is necessary to avoid putting too much stress on the rubber mounting of the engine suspension when swiveling the front axle support. To adjust the caster loosen the hexagon screws (10) and (13) on the right and left of the flat spring and also the hexagon nut (lock nut) (15) for the eccentric bolt (14). On the 2nd version front axle remove the lateral support strut on the front axle support.

To adjust the caster, mark the flat spring mounting on the chassis base panel on the left and on the right. Then adjust the eccentric bolt evenly at both sides with Special Wrench 111 589 00 09 or 111 589 02 09, checking the caster at the same time. Afterwards check the axle positioning distance of the front axle. Make sure that, when the front axle support is being adjusted with the eccentric bolt, the difference in the axle positioning distance between the left and right sides does not become excessive (see Table in Job No. 40-0).

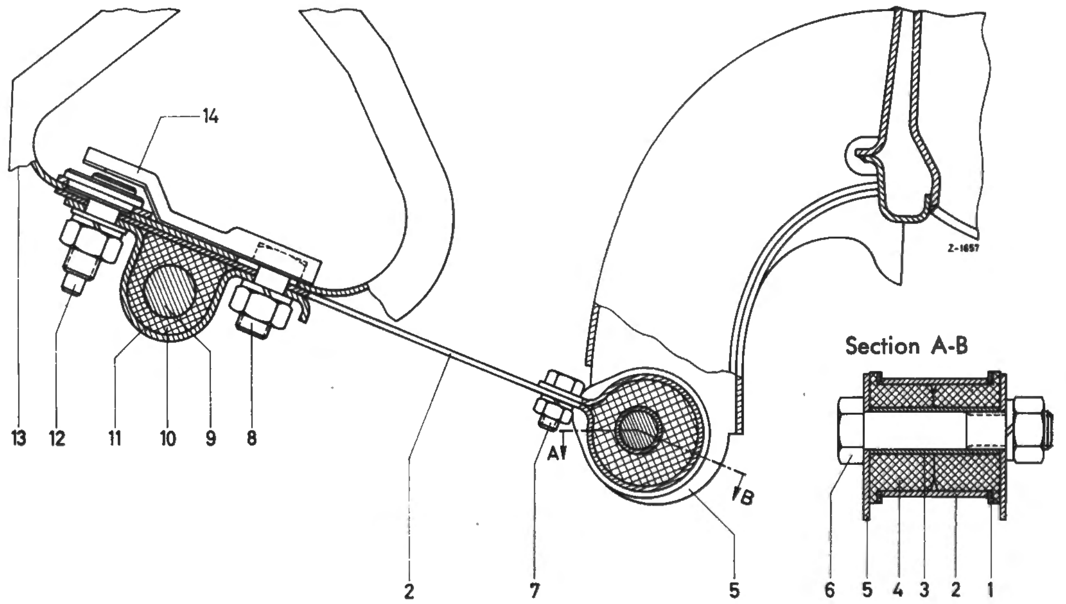


Fig. 40-3/4a

Longitudinal support of 2nd version front axle

1 Spacer ring
2 Flat spring
3 Spacer tube
4 Rubber mounting
5 Bearing bracket at front axle support
6 Hexagon screw with nut and lock washer
7 Hexagon screw (clamping screw) with nut and lock washer
8 Square screw with nut and lock washer
9 Torsion bar
10 Rubber mounting for torsion bar
11 Bracket for rubber mounting
12 Eccentric with nut, lock washer, and washer
13 Bearing bracket on chassis base panel
14 Cage for square screw and eccentric

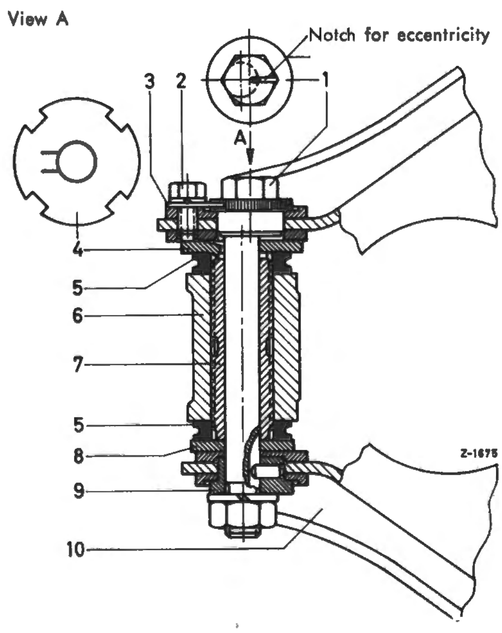


Fig. 40-3/5

1 Eccentric bolt for camber adjustment
2 Hexagon screw with lock washer
3 Locking plate
4 Adjusting washer for caster adjustment
5 Rubber sealing ring
6 King pin
7 Threaded bolt
8 Washer
9 Eccentric bushing with drive pin
10 Upper control arm

Tighten the hexagon screws or hexagon nuts fastening the flat springs with the prescribed tightening torque (see Job No. 33-0). After adjusting the caster at the flat springs, reinstall the lateral support strut without forcing it into position (see also Job No. 33-1).

To compensate differences in the caster between the left and right sides, loosen the hexagon nut of the eccentric bolt (1) and turn the threaded bolt (7) with Special Wrench 180 589 00 05 at the adjusting washer (4) (Fig. 40-3/5). No more than the permissible adjustment should be made at the steering knuckle, since the rubber ring (5) would be crushed on the one side whereas on the other side there would no longer be a perfect seal (see Table Job No. 40-0).

It is not permissible to adjust the caster by turning the upper control arm pivot pin in the threaded bushings.

The caster should be measured with Camber and Caster Gage 180 589 02 21 by measuring the front wheel camber with the wheels at 20° right and left lock.

If it is necessary to adjust the caster by means of the eccentric bolts on the flat springs for the front axle longitudinal support, Caster Gage 111 589 03 23 should be fitted to the two threaded bushings of the pivot pin for the lower control arm (Fig. 40-3/6).

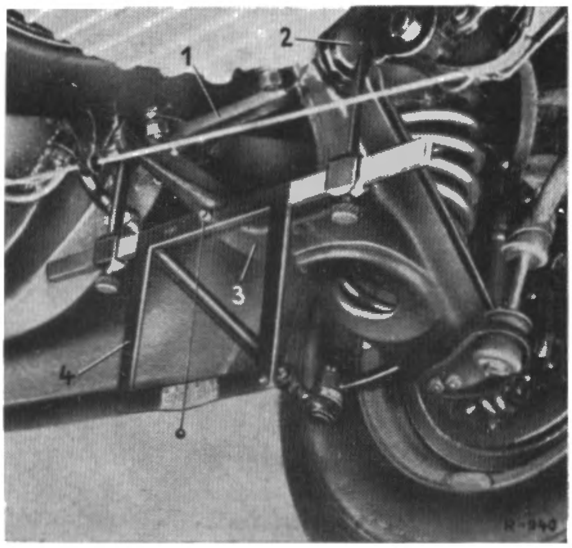


Fig. 40-3/6

1 Pivot pin for lower control arm
2 Slide for fastening the gage to the threaded bushing of the pivot pin
3 Lower control arm
4 Caster Gage 111 589 03 23

Note: The measurement of the caster at the pivot pin for the lower control arm only serves as a rough check while adjustments are being made at the flat springs. To determine the caster accurately, it must be measured at the wheel.

D. Front Wheel Track

The toe-in is adjusted by adjusting the length of the two tie-rods while the steering system is in the straight-ahead position and the check screw is installed (see Job Nos. 46-1 and 4).

In the case of the steering linkage of the 1st version front axle the ball head on the tie-rod is locked by means of a hexagon nut, with the left-hand thread on the steering gear arm or steering relay arm side. In addition, the lock nut with left-hand thread is marked with notches (see also Job No. 46-9).

In the case of the steering linkage of the 2nd version front axle the ball head is clamped to the tie-rod by a hexagon screw. The tie-rods should be mounted in such a way that the **left-hand thead** – seen in the direction of travel – is located on the **left-hand side** (see Job No. 46-9). It is advisable to check the position of the steering gear arm and the steering relay arm in the straight-ahead position before the toe-in is adjusted. To do this, place Check Gage 111 589 17 23 on the corresponding pair of pivot pins for the lower control arms. Check the distance from the ball studs of the tie-rod from this point (Fig. 40-3/7). The tolerance is ± 3 mm (see also "Position of Steering Gear Arm" in Job No. 46-0).

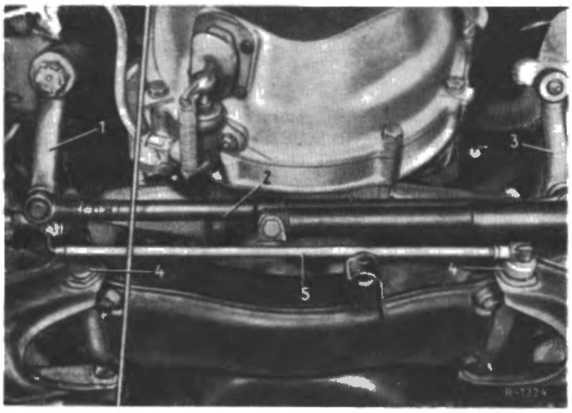


Fig. 40-3/7

1 Steering gear arm
2 Center tie-rod
3 Steering relay arm
4 Threaded bushing for pivot pin of lower control arm
5 Check Gage 111 589 17 23

After having adjusted the toe-in, check with the wheels at full left and right lock whether the stop face of the steering knuckle rests against the steering knuckle support. The steering nut limit stops in relation to the steering housing are an emergency arrangement to prevent damage to the steering gear.

E. Pivot Point Distance

To measure the pivot point distance, use distance "a" between the axis of the pivot pin for the lower control arm and the center of the measuring bolt (Figs. 40-3/8 and 8a). The steering gear arm and the steering relay arm must be in the straight-ahead position, i. e. the position corresponding to the center position of the steering system when the car is traveling straight ahead.

In the case of the steering linkage for the 1st version front axle the center tie-rod is detached from the levers and Measuring Bolt 111 589 01 21 (4) is installed instead (Fig. 40-3/8). If the pivot point distance is correct, there must be alignment between the extended axis of the pivot pin (1) for the lower control arm and the center of the measuring bolt (for tolerance see Job No. 40-0).

In the case of the steering linkage for the 2nd version front axle the tie-rod is detached from the steering gear arm and the steering relay arm and Measuring Bolt 111 589 07 21 (4) is installed instead (Fig. 40-3/8a). The prescribed check dimension is given in Job No. 40-0.

For measuring the pivot point distance, use Caster Gage 111 589 03 23 (5) which is fitted to the two threaded bushings (3) on the pivot pin (1) for the lower control arm (see Fig. 40-3/8). It is now easy to determine the pivot point distance from the strap of the gage by fitting a set-square. Distance "b" from the lower edge of the strap of the gage to the center of the measuring bolt (4) is 120 or 170 mm (Figs. 40-3/8 and 8a).

In special cases, e. g. after an accident, the distance "c" from the center of the front axle support to the center of the measuring bolt (4) on the steering gear arm and on the steering relay arm should also be measured in the straight-ahead position (for dimensions see Table in Job No. 40-0). To measure distance "c" first determine the front axle support by dividing the center distance between holes on the pivot pin (1) (Fig. 40-3/6). The distance between holes on the pivot pin is 140 mm.

Fig. 40-3/8

Pivot point distance for 1st version front axle (Checking with measuring bolt)

A Center front wheel or center front axle support
a Pivot point distance
b Distance between lower edge of caster gage strap and measuring bolt center
c Distance between center front axle support and measuring bolt center
1 Pivot pin for lower control arm
2 Front axle support
3 Threaded bushing on the pivot pin
4 Measuring Bolt 111 589 01 21
5 Caster Gage 111 589 03 23

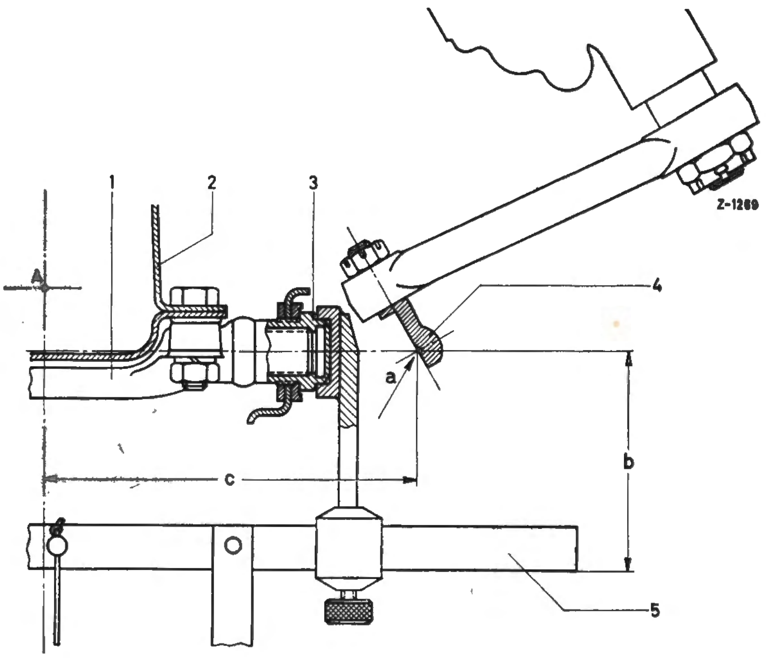
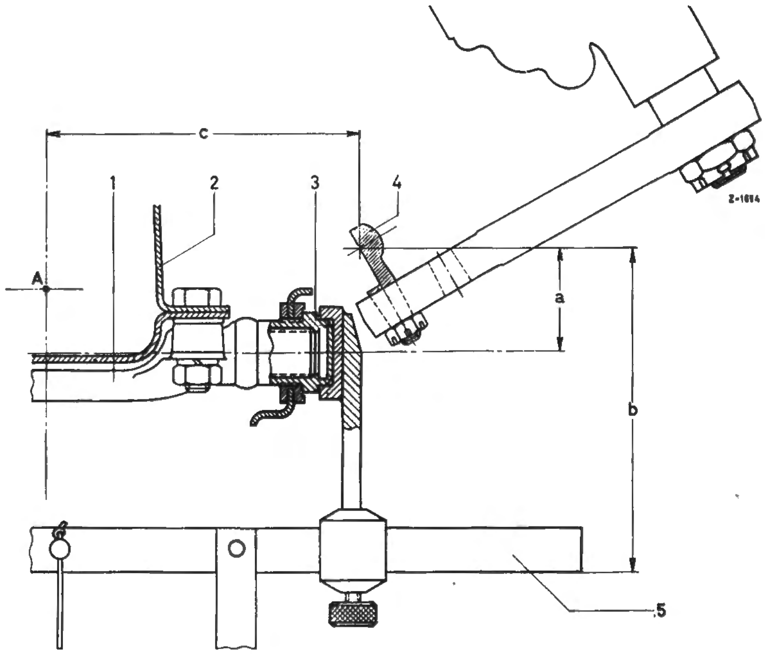


Fig. 40-3/8a

Pivot point distance for 2nd version front axle (Checking with measuring bolt)

A Center front wheel or center front axle support
a Pivot point distance
b Distance between lower edge of caster gage strap and measuring bolt center
c Distance between center front axle support and measuring bolt center (for special cases only)
1 Pivot pin for lower control arm
2 Front axle support
3 Threaded bushing on the pivot pin
4 Measuring Bolt 111 589 07 21
5 Caster Gage 111 589 03 23

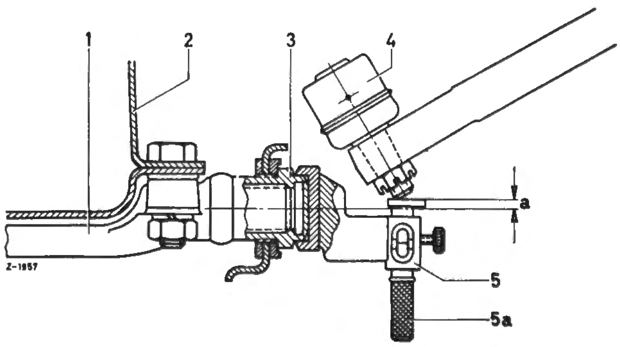


To provide a simple check for the pivot point distance on cars with 2nd version front axle, the Fixture 111 589 12 21 00 has been developed, which is designed for a pivot point distance of 49^{+1}_{-3} mm. This fixture measures not the direct pivot point but the distance "e" from the axis of the

Fig. 40-3/8b

Pivot point distance for 2nd version front axle (Checking with fixture)

a Pivot point distance
1 Pivot pin
2 Front axle support
3 Threaded bushing
4 Tie-rod ball head
5 Fixture 111 589 12 21 00
5a Slide



pivot pin for the lower control arm to the lower edge of the tie-rod ball pin (Fig. 40-3/8b). This distance corresponds to a distance of 4.5 $^{+1}_{-3}$ mm from center pivot pin to lower edge ball pin. The steering gear arm or steering relay arm should be swiveled in such a way that it points to the center of the pivot pin. The fixture is put on the threaded bushing of the lower control arm and the slide (5a) is pushed upward until it rests against the ball pin. If the pivot point is correct, the mark on the slide should be within the tolerance field of the fixture.

F. Wheelbase

The measuring points for the wheelbase "a" are the center of the wheel spindle of the front axle and the center of the rear axle shaft (see Fig. 40-3/10).
The wheelbase is measured with the complete Check Gage 111 589 02 23. To do this fit the front part of the gage at the center of the wheel spindle and the rear part at the center of the rear axle shaft (Fig. 40-3/9).
The wheelbase can only be measured accurate ly if the toe-in is correctly adjusted and the steering system is fixed in the center position by the check screw.

Fig. 40-3/9

1 Wheel spindle center
2 Rear axle shaft center
3 Front part of Check Gage 111 589 02 23
4 Center part of Check Gage 111 589 02 23
5 Rear part of Check Gage 111 589 02 23

G. Axle Positioning Distance

The check bore 'P' below in the second cross member at the chassis base panel is used for checking the axle positioning distance of the front and rear axles (Fig. 40-3/10). From this measuring point the distance 'b' to the front axle and the distance 'c' to the rear axle are measured to the right and left.

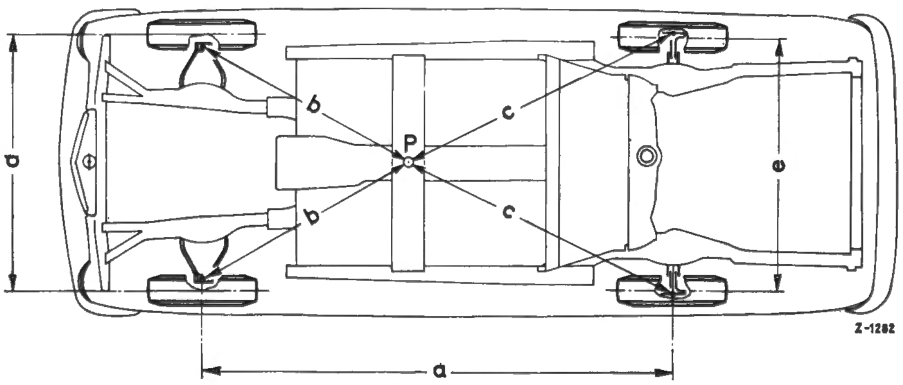


Fig. 40-3/10

a Wheelbase
b Front axle positioning distance
c Rear axle positioning distance
d Front axle track
e Rear axle track
P Check bore in the second cross member on the chassis base panel

The permissible differences between left and right should not be exceeded.
In the case of the front axle the axle positioning distance can be corrected to a limited extent by adjusting the eccentric bolt on the flat spring for the longitudinal support of the front axle support, but care should be taken not to put too much stress on the rubber mounting. If any considerable difference in the axle positioning distance is discovered, the front axle support and the control arms should be checked.

In the case of the rear axle, too great a difference in the axle positioning distance can be corrected by adjusting the cross strut (5) for the rear axle suspension, but care should be taken that the center position of the rear axle is not changed more than is permissible (see Fig. 40-3/14).

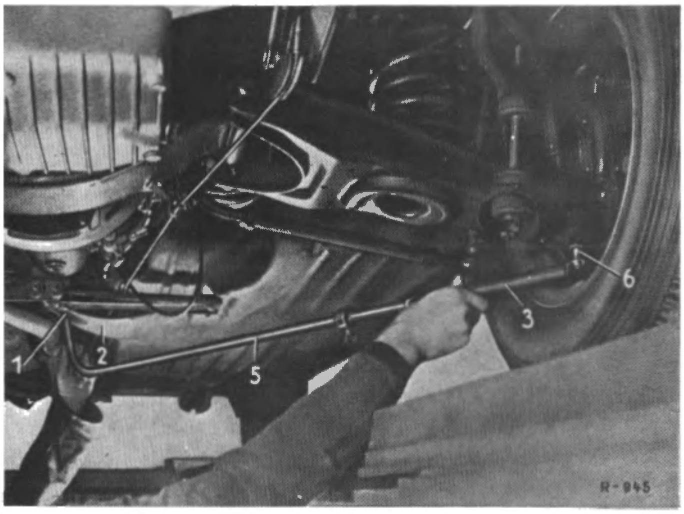


Fig. 40-3/11

1 Check bore in cross member
2 2nd Cross member on chassis base panel
3 Front part of Check Gage 111 589 02 23
4 Rear part of Check Gage 111 589 02 23
6 Center of king pin

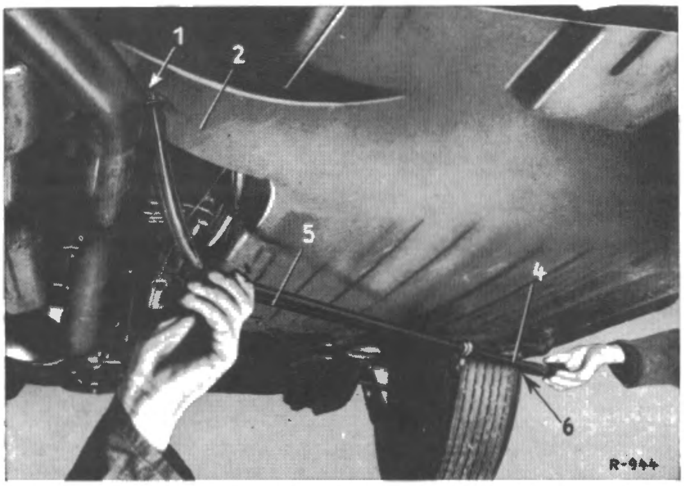
Insert the check gage in the check bore (1) in the cross member at the chassis base panel and measure the distance from the center (6) of the king pin left and right (Fig. 40-3/11).

To check the axle positioning distance of the rear axle use the rear part (5) and the center part (4) of Check Gage 111 589 02 23 (Fig. 40-3/12).

The gage is fitted to the check bore (1) in the cross member (2) on the chassis base panel. Then the distance left and right from the center (6) of the rear axle shaft is measured on the left and on the right (Fig. 40-3/12).

Fig. 40-3/12

1 Check bore in cross member
2 2nd cross member on chassis base panel
4 Center part of Check Gage 111 589 02 23
5 Rear part of Check Gage 111 589 02 23
6 Center in rear axle shaft



H. Center Position of the Rear Axle

Besides the correct axle positioning distance also ther center position of the rear axle is of importance. It is checked with Check Gage 111 589 00 21 (Fig. 40-3/13).

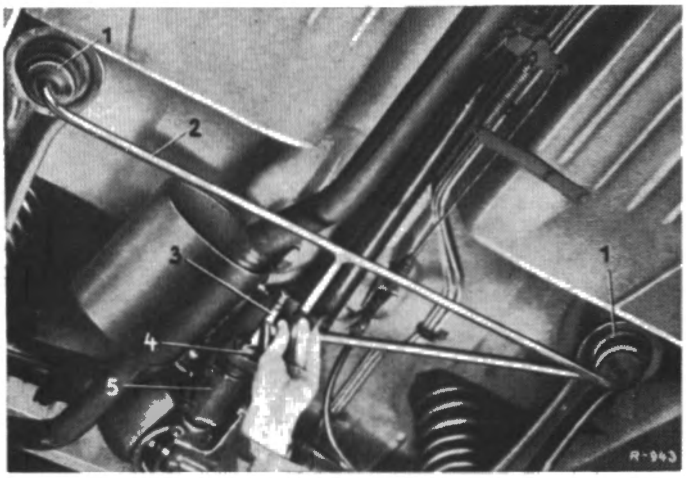


Fig. 40-3/13

1 Front mountings of the torque arms
2 Check Gage 111 589 00 21
3 Measuring bolt of gage
4 Hexagon screw in connecting pin
5 Support of rear axle suspension

The check gage is fitted on the right and left in the cups at the front mountings (1) of the torque arms. If the center position is correct, the measuring bolt of the gage points at the center of the hexagon screw of the connecting pin of the rear axle suspension (Fig. 40-3/13).

To adjust the center position and the axle positioning distance of the rear axle, loosen the hexagon nut (lock nut) (6) and the hexagon nut with lock nut on the cross strut (5). Then turn the cross strut in or out as required (Fig. 40-3/14).

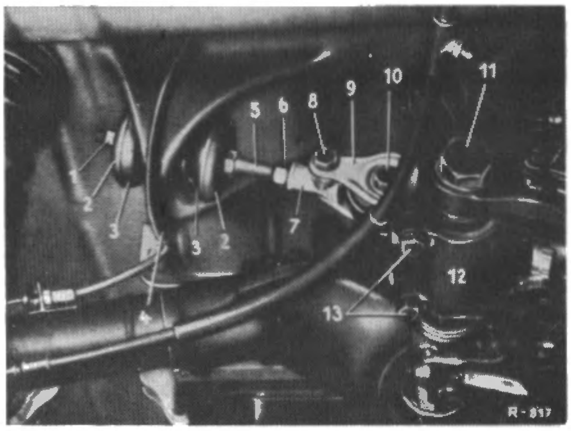


Fig. 40-3/14

1 Hexagon nut with lock nut
2 Rubber buffer
3 Cup
4 Bracket on chassis base panel
5 Cross strut
6 Hexagon nut (lock nut)
7 Rear link
8 Hexagon screw with spring washer
9 Front link
10 Hexagon screw with spring washer
11 Hexagon screw for connecting pin of rear axle suspension
12 Support of rear axle suspension
13 Hexagon screws (clamping screws) for the support on the rubber mounting

I. Control Arm Position of the Front Axle

The position of the control arms is of very great importance for the riding qualities of the car and the free movement of the wheels at full lock. It depends on the trim dimension of the front springs and the load in the car. The control arm position is measured by determining on the lower control arm the difference in level "a" between the inner fulcrum at the pivot pin (2) and the threaded bolt (4) for the lower connection of the steering knuckle to the control arm (Fig. 40-3/14).

The difference in level "a" should be measured under test load. For specified values see Tables in Job No. 40-0.

Two measurements are necessary. Before the first measurement is taken, the car should be lifted at the front bumper and then let down. Before the second measurement is taken, the car should be pressed down in front and then be released to its normal position. The measurement value is the mean value of these two measurements.

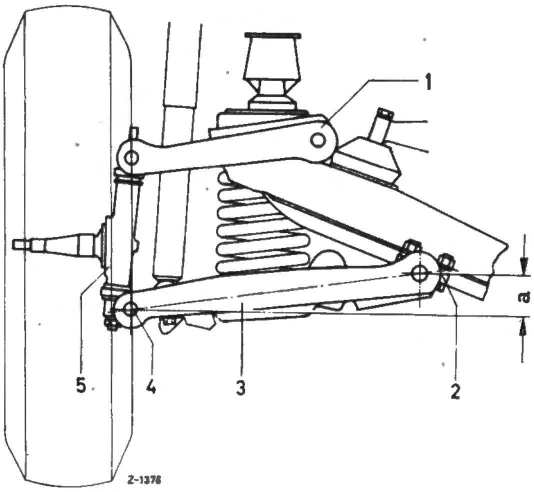


Fig. 40-3/15

a Difference in level
1 Upper control arm
2 Pivot pin for the lower control arm
3 Lower control arm
4 Threaded bolt for connecting the steering knuckle to the lower control arm
5 Steering knuckle

As a rule, the specified control arm position can be achieved by installing the rubber washers associated with the individual front springs as listed in the Table "Front Springs, Corresponding Color Code" in Job No. 32-0. In certain cases it may be necessary to install different rubber washers or rubber mountings. But in the case of the rubber washers it should be remembered that their total height must not exceed 12 mm since otherwise the spring is no longer properly centered.

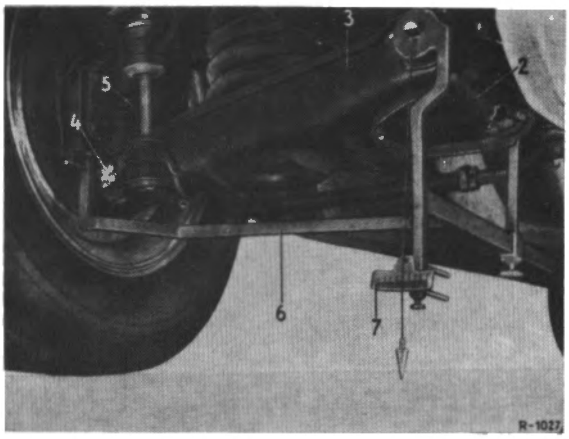


Fig. 40-3/16

2 Pivot pin for the lower control arm
3 Lower control arm
4 Threaded bolt for connecting the steering knuckle to the lower control arm
5 Steering knuckle
6 Tester 111 589 03 21
7 Scale of Tester

The difference in level is read off the scale (7) of the Tester in mm. One graduation of the scale corresponds to a change in height of 2 mm (Fig. 40-3/15).

Whenever the control arm position is changed by installing other rubber washers or rubber mountings or front springs, it is imperative that both camber and toe-in of the front wheels should be checked afterwards.

Job No.
40-4

Disk Wheels

Modification: Rim sections and mid-centering added

A. Rim

Some time ago, the rim section of the disk wheels was modified. The hump on the outer rim shoulder (hump shoulder) considerably improves the bead seating and, in the case of a puncture, prevents the tire from being forced over the rim (Fig. 40-4/2). The shape of the inside rim shoulder was modified at the same time (ledge shoulder). On Model 230 SL a rim is used for the radial tires which has a hump shoulder on both sides (Fig. 40-4/3).

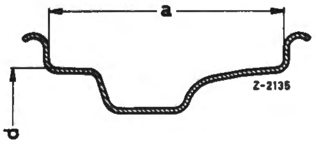


Fig. 40-4/1
Previous rim section

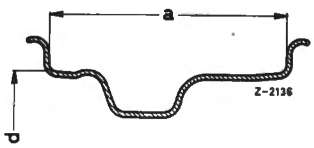


Fig. 40-4/2
Present rim section

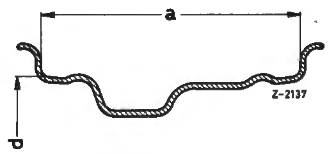


Fig.40-4/3
Rim section for

Since more force is required to remove the tire from the disk wheel with the new rim section, it is recommended to use a special tire removal device.
All rims have an 11.5 mm ϕ valve hole and will only take thin-stem rubber valves.

B. Ornamental Hub Cap

On the previous version of the disk wheel the hub cap is clipped on to the sprung pins (4) by three clips (Fig. 40-4/4), whereas the present version of the cap is clipped on to three spherical shouldered pins riveted to the disk wheel (Fig. 40-4/5). The hub cap can only be mounted properly and securely, especially on the unsprung pins of the disk wheel, if the cap is not damaged. The rolled outer edge must on no account be bent since bent caps do not provide a firm contact on all three points and are liable to be noisy. After fitting the hub cap, give a light twist.

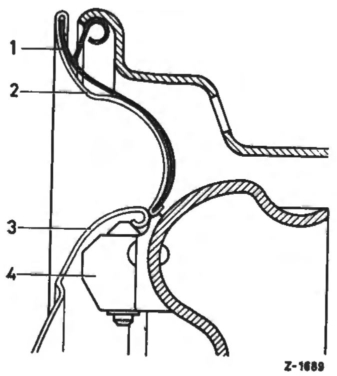


Fig. 40-4/4
1st version

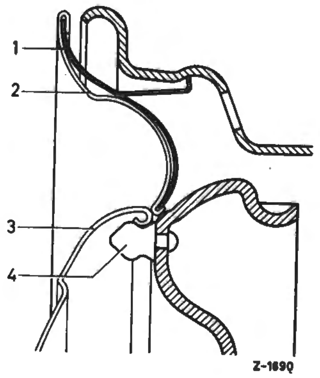


Fig. 40-4/5
2nd version

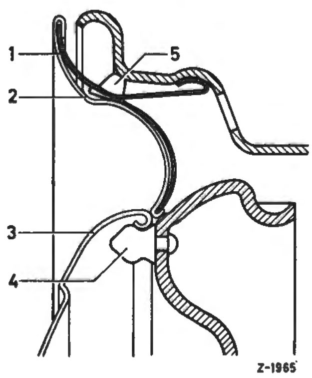


Fig. 40-4/6
3rd version

1 Retaining spring for ornamental wheel cover
2 Ornamental wheel cover
3 Ornamental hub cap
4 Pin for ornamental hub cap
5 Rubber buffer

C. Ornamental Wheel Cover

The ornamental wheel cover is fastened to the disk wheel by steel retaining springs. The 1st version wheel cover has four rolled retaining springs (1) which press against the rim edge (Fig. 40-4/4). The 2nd version wheel cover has four claw-type retaining springs which press against the rim shoulder (Fig. 40-4/5). The 3rd version ornamental wheel cover has four retaining springs bent at the front. The wheel cover is supported against the rim shoulder by rubber buffers (5) on the retaining springs (Fig. 40-4/5). The ornamental wheel covers can be used on all types of disk wheels. It is also possible to attach the 2nd and 3rd version retaining springs subsequently to the wheel cover. To change the retaining springs use Special Tool 111 589 11 61.

D. Attachment of Disk Wheels

The disk wheel previously used was centered by five spherical collar nuts on the wheel fixing bolts and was pressed against the flange of the front wheel hub or rear axle shaft.
Since accurate concentric running of the wheels is of extreme importance at high speeds, the new version disk wheel is provided with an internal recess and is centered on the front wheel hub and the rear axle shaft. The wheels are now fastened by means of spherical collar screws (Figs. 40-4/7 and 8).

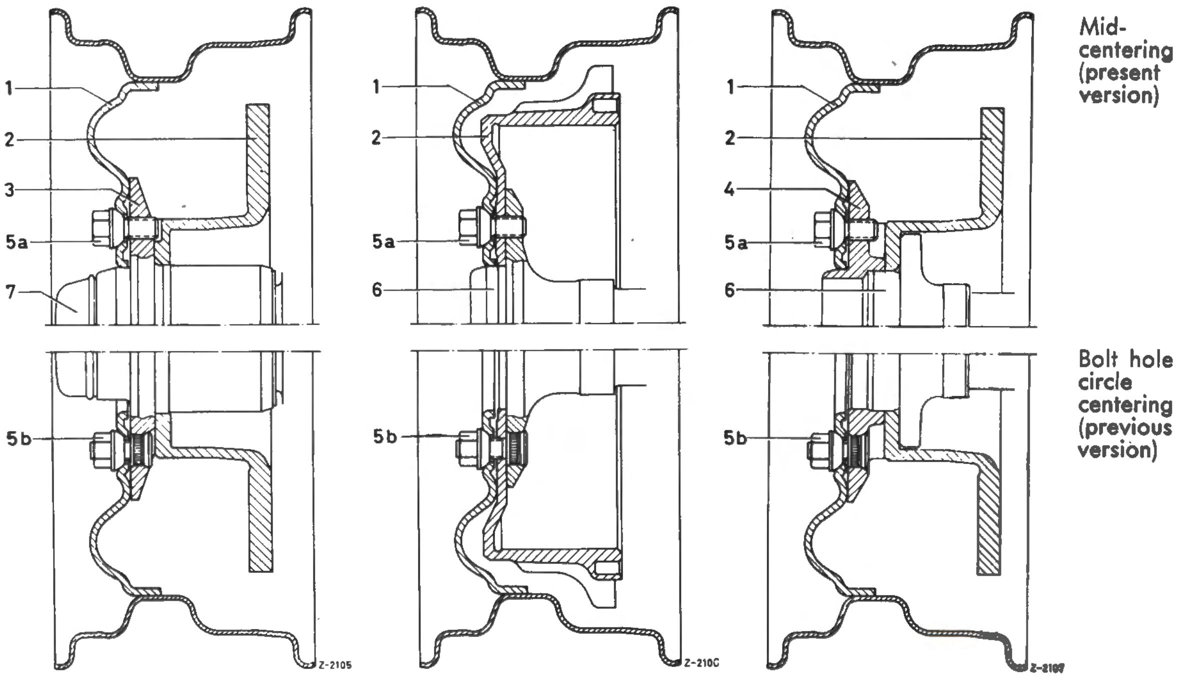


Fig. 40-4/7
Front axle
Model 190 c, 190 Dc
220 b, 220 Sb
220 SEb, 300 SE
230 SL

Fig. 40-4/8
Rear axle
Model 190 c, 190 Dc
220 b, 220 Sb
220 SEb, 230 SL

Model 300 SE

1 Disk wheel
2 Brake disk or brake drum
3 Front wheel hub
4 Wheel fixing disk
5a Spherical collar screw
5b Wheel fixing bolt with spherical collar nut
6 Rear axle shaft
7 Hub cap

Note: Mid-centering disk wheels can also be fitted to the front wheel hubs and rear axle shafts without mid-centering. Vice versa, disk wheels without mid-centering (e. g. a set of available winter tires) can still be fitted. However, 1st version 15" disk wheels (Part No. 186 400 17 02) with 18 mm wheel fixing holes require larger spherical collar screws (Part No. 112 401 00 70) (see Table "Attachment of Disk Wheels" in Job No. 40-0).

To facilitate installation of the mid-centering disk wheels, the wheel cap (7) of the front wheel hub and the fitting piece on the rear axle shaft have been given a conical shape (Figs. 40-4/7 and 8). To facilitate alignment of the disk wheel fixing holes with the tapped holes in the front wheel hub and the rear axle shaft, the centering bolt (1) should be inserted in the topmost hole before the wheel is fitted. This centering bolt is located in a clamp in the trunk compartment right beside the combination wrench (Figs. 40-4/9 and 10).

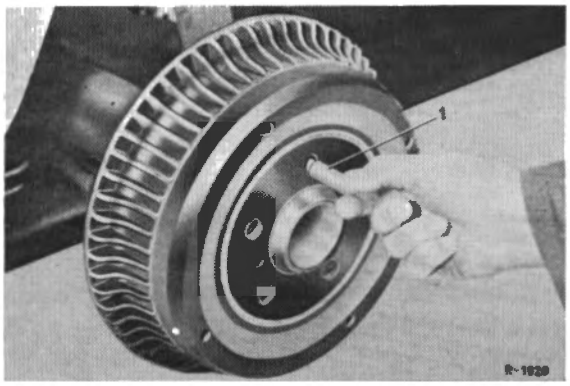


Fig. 40-4/9

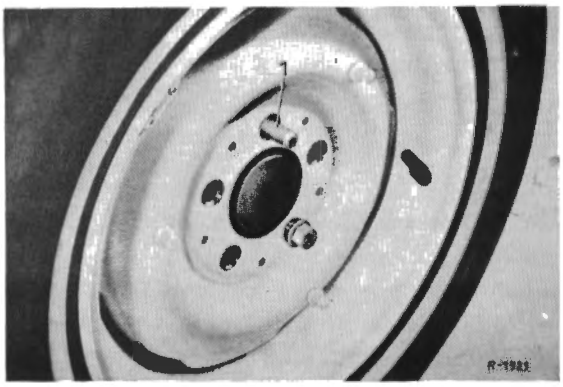


Fig. 40-4/10

1 Centering bolt

Adjustment of Car Level on Cars with Air Suspension System

Job No.
40-5

Note: The correct car level corresponds to the car design height. The car design height is determined on the front axle by the lower control arm position and on the rear axle by the rear wheel camber. For details about measurements see Job No. 40-3.

1. Put car over a measuring pit. The front and rear wheels should be placed on ball plates with a lateral movement.

2. Connect a pressure gage to the air reservoir and measure the pressure in the air reservoir (see Job No. 32-12, Section A).

   Note: During these adjustment operations the working pressure should not be less than 12 atm.
   If necessary, fill up the system (see Job No. 32-12, Section A).

3. Detach the connecting rods (10) on the two leveling valves of the front axle and on the leveling valve of the rear axle. To do this, unscrew the hexagon nut on the lower ball joints (Figs. 40-5/1 and 40-5/2).

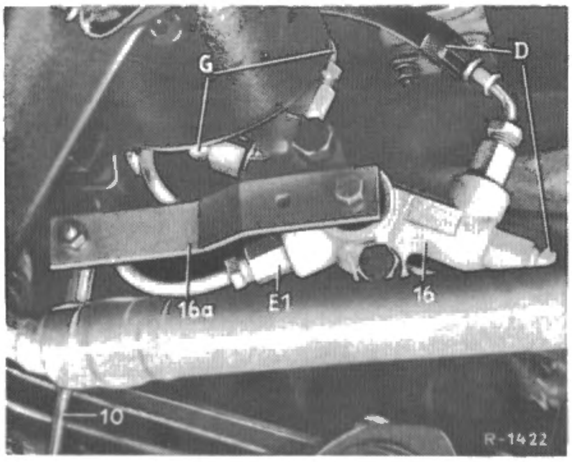


Fig. 40-5/1

D Pressure line (reduced working pressure) from valve unit to front leveling valves
E1 Connecting line from front leveling valve to air chamber
G Exhaust line from front leveling valve to valve unit

10 Connecting rod
16 Front leveling valve, left
16a Lever

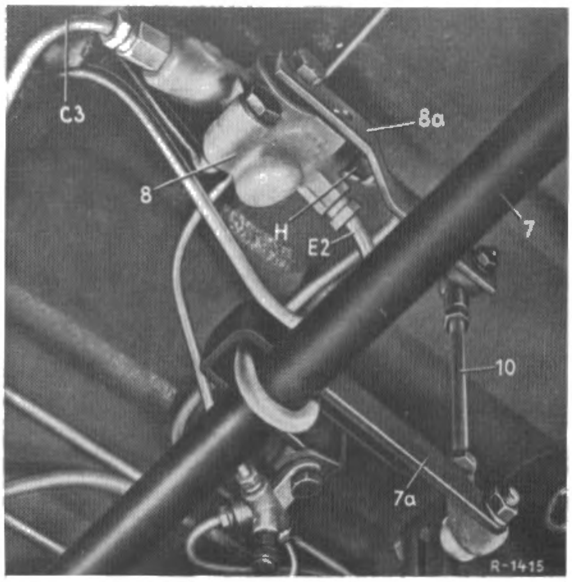


Fig. 40-5/2

C3 Pressure line (full working pressure) from valve unit to rear leveling valve
E2 Connecting line from rear leveling valve to air chamber
H Exhaust line from rear leveling valve to valve unit

7 Torsion bar on rear axle
7a Lever on torsion bar
8 Rear leveling valve
8a Lever

4. Check the ball joints of the connecting rods for ease of movement and for wear. If necessary, remove the locking wire, pull off the ball pin and coat the ball socket with Molycote paste. Replace worn ball joints.

5. Get the car to its design height by actuating the leveling valves (for values see Table in Job No. 40-0). If the lever on the leveling valve is moved upward, air enters, if it is moved downward, air is exhausted (Fig. 40-5/3).

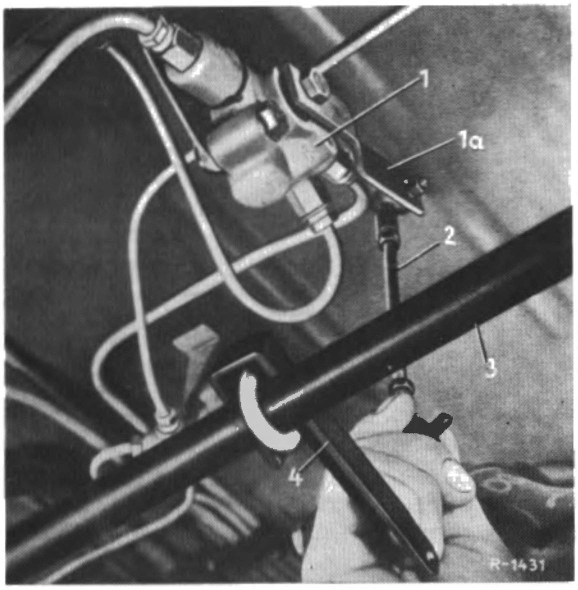


Fig. 40-5/3

1 Rear leveling valve
1a Lever
2 Connecting rod
3 Torsion bar on rear axle
4 Lever on torsion bar

6. Fix the leveling valve in its neutral position by Pin 112 589 01 63 00 (Fig. 40-5/4).

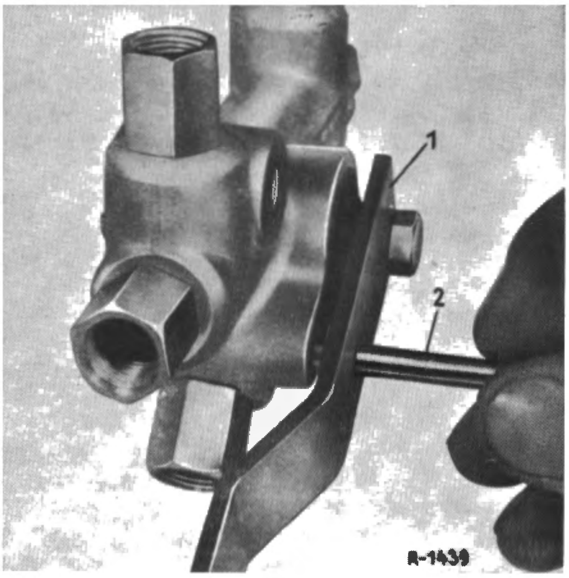


Fig. 40-5/4

1 Lever on leveling valve
2 Fixing Pin 112 589.01 63 00

Note: The Fixing Pin 112 589 01 63 00 is made of plastics. If it should remain in the valve after the adjustment operations have been finished, the plastic pin will be sheared as soon as the lever on the leveling valve is moved. If a steel pin were used instead, the valve would inevitably be destroyed.

7. Adjust the connecting rods to the prescribed length and remove the fixing pin. Attach the connecting rod and attach the ball pin of the lower joint to the lower control arm and to the lever of the torsion bar.

Note: The lever (5) on the torsion bar must be mounted in such a way that in the normal design position of the rear axle (prescribed rear wheel camber) both ball joint and torsion bar are on the same level (Fig. 40-5/5). Seen in the direction of travel, the connecting rod must always be vertical. If necessary, detach the fixing strap (7) and correct the position of the lever accordingly.

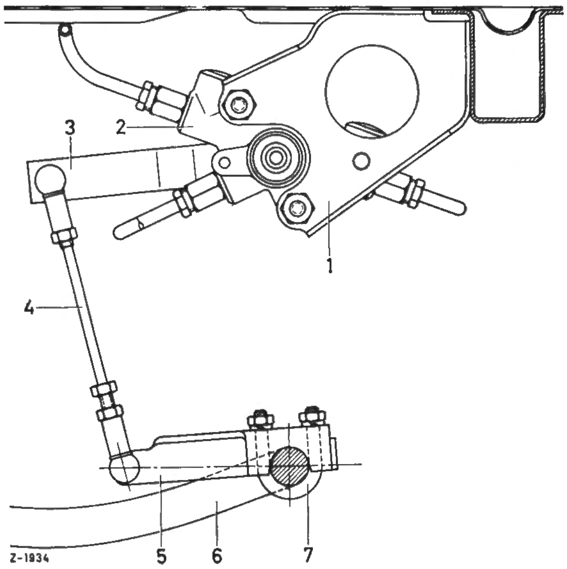


Fig. 40-5/5

1 Bracket on chassis base panel
2 Leveling valve
3 Lever on leveling valve
4 Connecting rod
5 Lever on torsion bar
6 Torsion bar
7 Fixing strap

The basic dimension for the length of the connecting rod of the rear leveling valve measured from center to center ball joint is given in Job No. 32-0.

Propeller Shaft

Group 41

	Job No.
Propeller Shaft	41-0
General Data, Dimensions, and Tolerances	
Removal and Installation of Propeller Shaft	41-1

Job No.
41-0

Propeller Shaft

General Data, Dimensions, and Tolerances

*Modification: Models as from August 1965 added; other modifications marked **

Torque Readings

Models 190 c to 300 SEL

Hexagon nuts for the fitting bolts at the front end of the shaft plate	4.3 mkg
Hexagon nuts for the cylindrical bolts at the universal joints	4.3 mkg[1])*
Grooved nut on the joint flange of the front propeller shaft	12 mkg
Clamping nut on the front propeller shaft or intermediate shaft	20 mkg

[1]) For attaching the universal joints use only hexagon nuts of quality 8 G (Part No. 000 936 01 00 14) for the cheese head screws.

Removal and Installation of Propeller Shaft

Job No.
41-1

Modification: Completely Revised

Removal:

1. Mark the position of the support (12) of the rear engine suspension in relation to the chassis base panel. Support the transmission, then unscrew the engine support (11) at the transmission and the support (12) on the chassis base panel and remove together with the rubber mounting (Fig. 41-1/1).

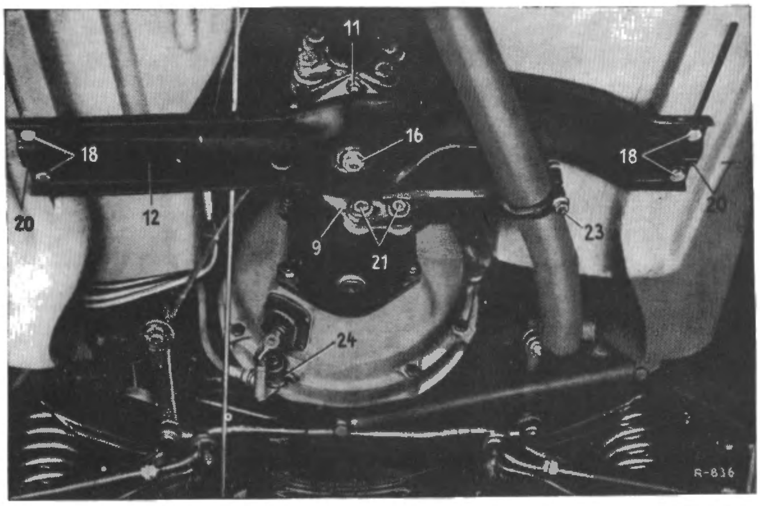


Fig. 41-1/1

9 Mounting plate for exhaust pipe support bracket
11 Engine support with rubber mounting
12 Support of rear engine suspension
18 Hexagon screws for fastening the support (12) to the chassis base panel
20 Position marking
21 Hexagon screws for the exhaust pipe support bracket (23)
23 Bracket with pipe clip and clamping screw for exhaust pipe support
24 Extraction cylinder for clutch actuating mechanism

2. Unscrew the castle nuts or self-locking nuts of the fitted screws (1) and (2) from the three-way flange of the transmission and from the shaft plate (3). Remove the screws together with the washers (Fig. 41-1/2).

3. After tapping up the locking plates (2), unscrew the hexagon nuts (3) of the four cheese head screws (1) which fasten the rear propeller shaft to the joint flange of the rear axle and remove the screws (Fig. 41-1/3).

Note: For turning and holding the propeller shaft while loosening the nuts use a wrench which can be made in the shop in accordance with Fig. 41-1/4. If an unsuitable tool is inserted in the universal joint instead of this wrench there is a danger that the seals on the universal joint spider are damaged and that the universal joint becomes unserviceable because of premature wear.

4. Unscrew the two hexagon screws (6) fastening the bearing bracket (3) for the propeller shaft intermediate bearing to the chassis base panel (Fig. 41-1/5).

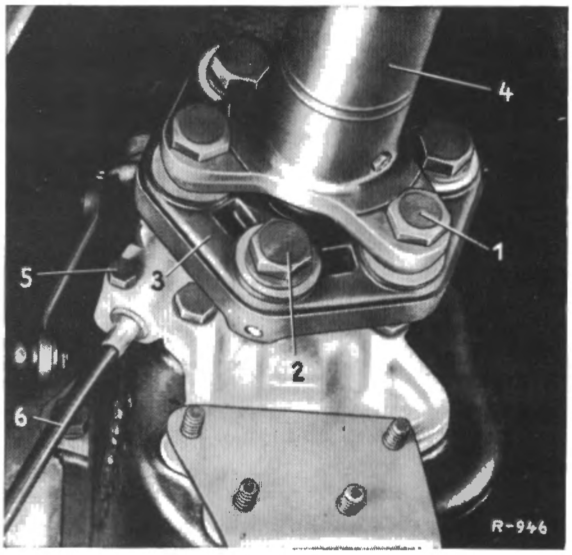


Fig. 41-1/2

1 Fitted screws for propeller shaft at the shaft plate
2 Fitted screws for shaft plate at the transmission
3 Shaft plate
4 Front propeller shaft
5 Hexagon screw (clamping screw)
6 Speedometer drive shaft

5. Push the propeller shaft back a little and remove backward (Fig. 41-1/6). Remove the shaft plate (11) and pull the rubber sealing ring (3) from the journal of the transmission main shaft (Fig. 41-1/9).

Note: To remove the propeller shaft it is not necessary to detach the front and center brake cables.

6. Check the shaft plate.

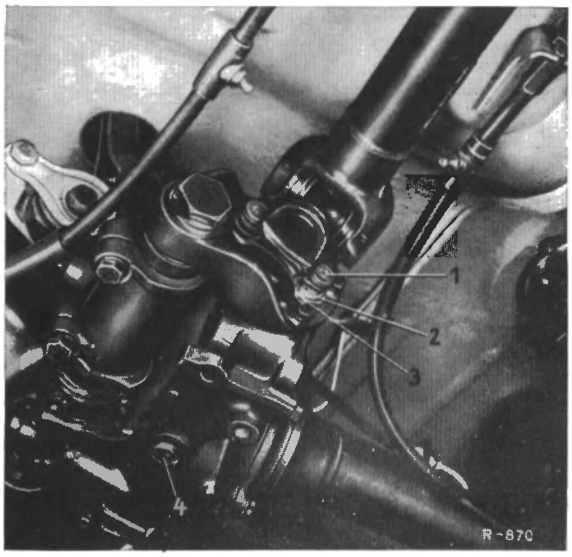


Fig. 41-1/3

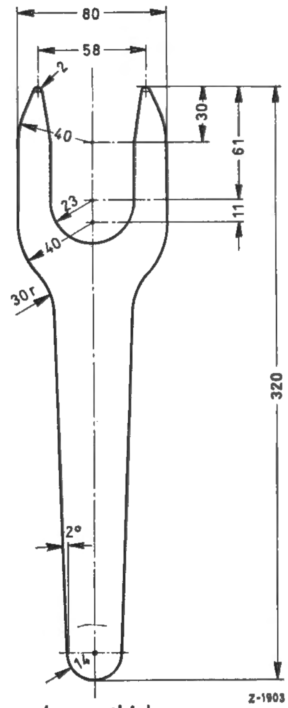
1 Cheese head screws
2 Locking plates
3 Hexagon nuts
4 Oil drain plug

Installation:

7. Check the transmission three-way flange and the joint flange on the rear axle for run-out (see Job Nos. 26-0 and 25-0). For this purpose fasten Tester 136 589 04 21 00 to the transmission and to the rear axle housing (Figs. 41-1/7 and 41-1/8).

8. If the run-out is excessive, try changing the position of the flange on the transmission main shaft or on the drive pinion. If this does not improve the situation the flanges can be re-turned (see Job Nos. 26-0, 35-0 and 35-8).

9. Attach the shaft plate (11) to the transmission three-way flange with the three **short** fitted screws (see Job No. 41-0), remembering the washers (10a) between the screw head and the shaft plate (11) (Fig. 41-1/9). Tighten the castle nuts or self-locking nuts and cotter the castle nuts (for tightening torque see Job No. 41-0).



4 mm thick
Edges broken

Fig. 41-1/4

Note: Before using the self-locking nuts again check whether they are serviceable: the polyamide locking ring in the nut must be in such a condition that it is **impossible** to screw the nut on the screw by hand.

During installation it is important to make sure that the double links of the shaft plate are under tensile stress in the direction of rotation of the engine.

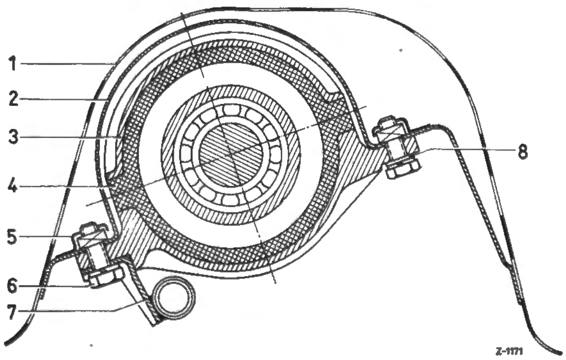


Fig. 41-1/5

1 Chassis base panel
2 Propeller shaft housing
3 Bearing bracket
4 Rubber mounting
5 Cage nut
6 Hexagon screw with lock washer
7 Cable bracket
8 Washer

For identification purposes the first bore of the double link is provided with a small nose "a" which must always point

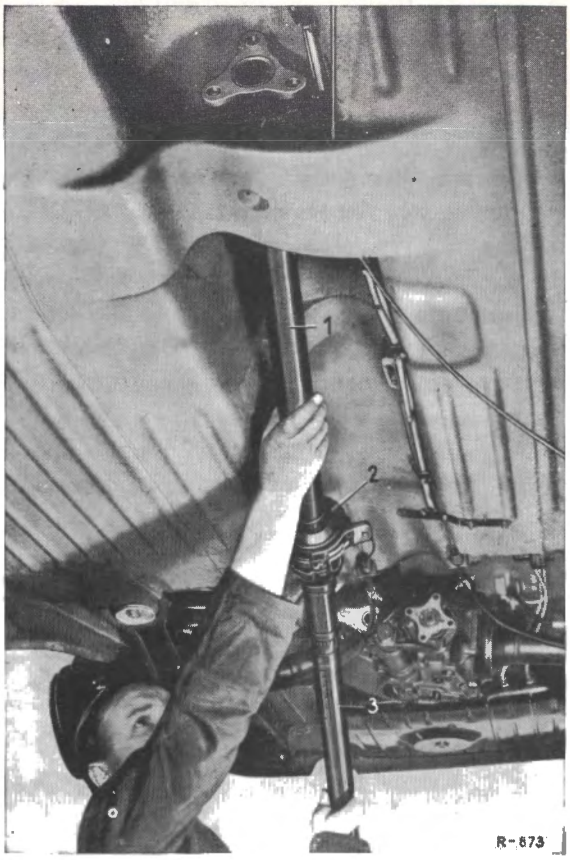


Fig. 41-1/6

1 Front propeller shaft
2 Propeller shaft intermediate bearing
3 Rear propeller shaft

in the direction of the transmission. The bore (1) opposite the small nose must be connected to the transmission three-way flange (Fig. 41-1/10).

10. Check the rubber sealing ring (3) and push it on the transmission main shaft journal (Fig. 41-1/9).

11. Install the propeller shaft, at the same time carefully pushing the locating ball in the center cross on the transmission main shaft journal. Screw in the hexagon screws (6) on the intermediate bearing but do not tighten them yet. (Fig. 41-1/5).

12. Fasten the front propeller shaft plate. To do this insert the three **long** fitted screws (see Job No. 41-0) and fit the washers (10b) (Fig. 41-1/9). Tighten the castle nuts for tightening torque see Job No. 41-0).

Note: The fitted screws with cottered castle nuts are interchangeable with the self-locking nuts as a set.

13. Screw the rear propeller shaft to the joint flange of the rear axle. Use new locking plates for the cheese head screws and if necessary use new nuts (Fig. 41-1/3).

14. Install the rear engine suspension (see Job No. 24-1).

15. Tighten the two hexagon screws (6) on the propeller shaft intermediate bearing, taking care to ensure that the brake cable bracket (7), if installed, is in the correct position (Fig. 41-1/5).

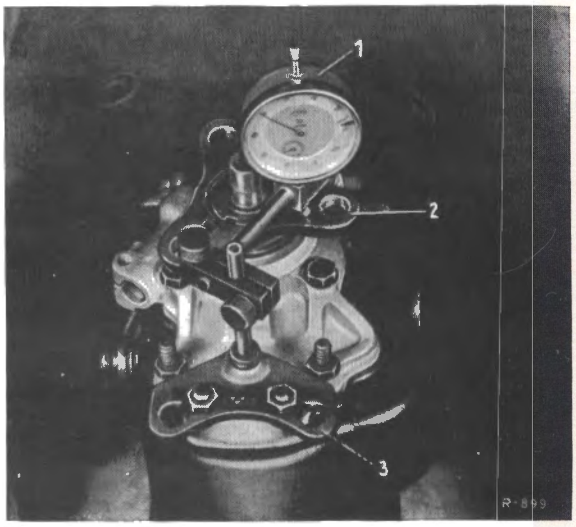


Fig. 41-1/7

1 Dial gage 2 Three-way flange 3 Tester 136 589 04 21 00

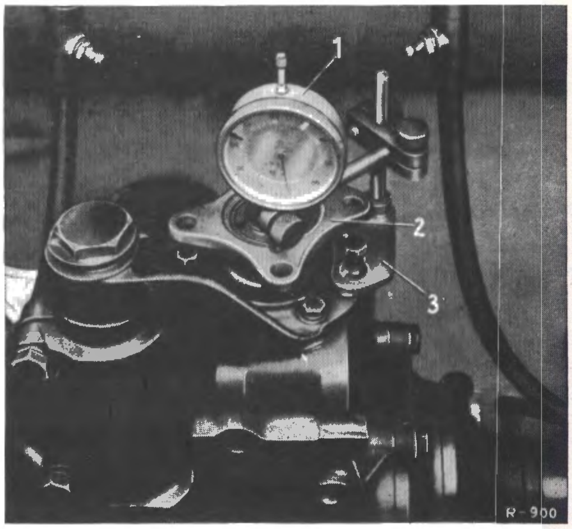


Fig. 41-1/8

1 Dial gage 2 Joint flange 3 Tester 136 589 04 21 00

16. Press grease into the grease fittings on the propeller shaft:

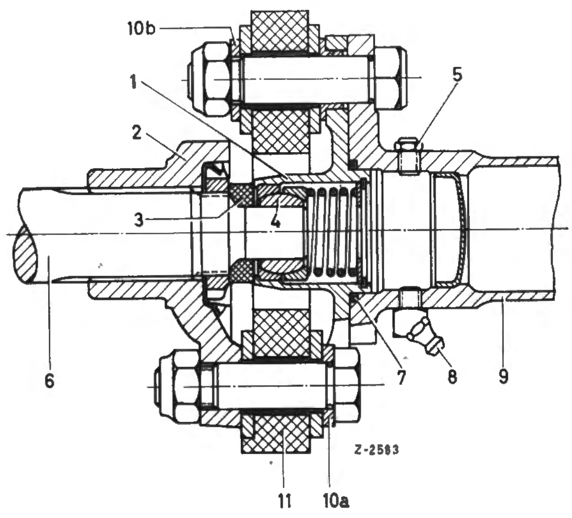


Fig. 41-1/9

1 Center cross
2 Three-way flange on the transmission main shaft
3 Rubber sealing ring
4 Locating ball
5 Relief valve
6 Transmission main shaft
7 Rubber sealing ring
8 Piston rim grease fitting
9 Front propeller shaft
10a 10b Washer
11 Shaft plate

a) Grease fitting (8) for the center cross on the front propeller shaft (Fig. 41-1/9).

The relief valve (5) permits air to escape during lubrication. As soon as grease emerges from the relief valve lubrication is completed.

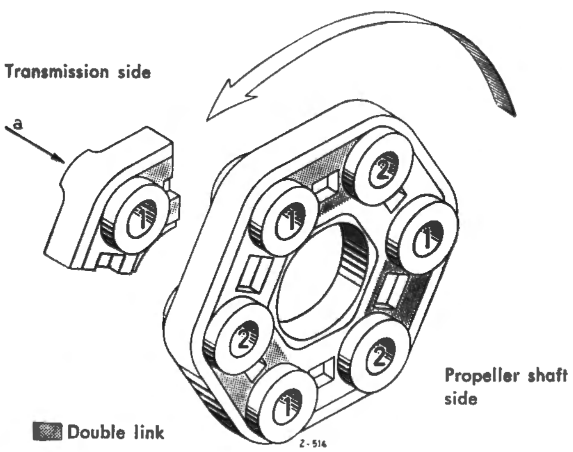


Fig. 41-1/10

1 Connect to three-way flange of the transmission
2 Connect to three-way flange of the propeller shaft

b) Grease fitting (19), if installed, for the annular grooved bearing (10) of the propeller shaft intermediate bearing (Fig. 41-1/11).

c) Grease fitting (23) on the slip coupling of the rear propeller shaft (Fig. 41-1/11). The slip coupling of the rear propeller shaft must not be overlubricated. If during lubrication grease emerges at the end of the splines lubrication is completed. If it becomes obvious during lubrication that the slip coupling is moving in the splines because of axial thrust, lubrication should be stopped immediately since otherwise the shaft plate would be strained.

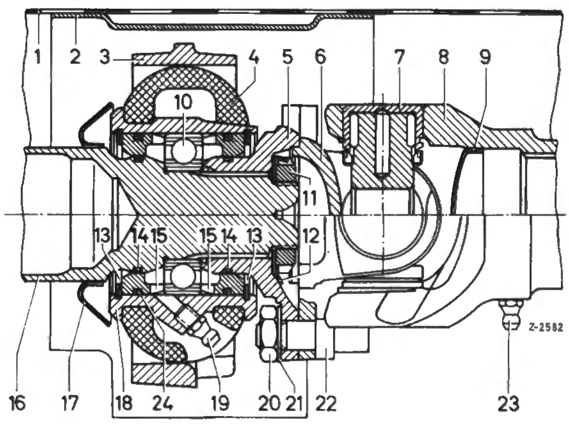


Fig. 41-1/11

Intermediate bearing requiring maintenance

1 Chassis base panel
2 Propeller shaft housing
3 Bearing bracket
4 Rubber mounting
5 Joint flange on the front propeller shaft
6 Joint flange on the rear propeller shaft
7 Needle bearing for universal joint
8 Slip coupling of rear propeller shaft
9 Cover
10 Annular grooved bearing
11 Grooved nut
12 Locking plate
13 Snap ring
14 Sealing ring
15 Spacer ring
16 Front propeller shaft
17 Boot
18 Bearing housing
19 Grease fitting
20 Hexagon nut
21 Locking plate
22 Cheese head screw
23 Grease fitting
24 Rubber sealing ring

d) The universal joints on the rear propeller shaft require no maintenance — in other words, during assembly the joints are given a supply of grease sufficient for their service life and subsequent lubrication is unnecessary. These universal joints have no grease fittings on the universal joint spider (Fig. 41-1/11).

Changes in the Removal and Installation Procedures for Propeller Shafts with Clamp Nut on the Models as from August 1965

Models 200, 200 D, 230, 230 S, 250 S, 250 SE, 300 SEb, 300 SEL as well as 300 SE/C and 230 SL as from August 1965 are equipped with split two-part or three-part propeller shafts (Figs. 41-1/12 and 13).

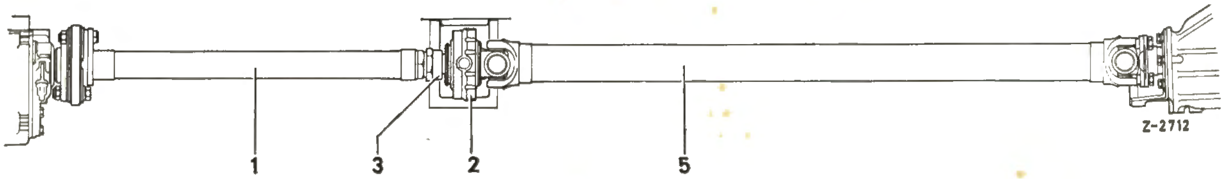


Fig. 41-1/12 Two-part propeller shaft

1 Front propeller shaft
2 Intermediate bearing
3 Clamp nut
5 Rear propeller shaft

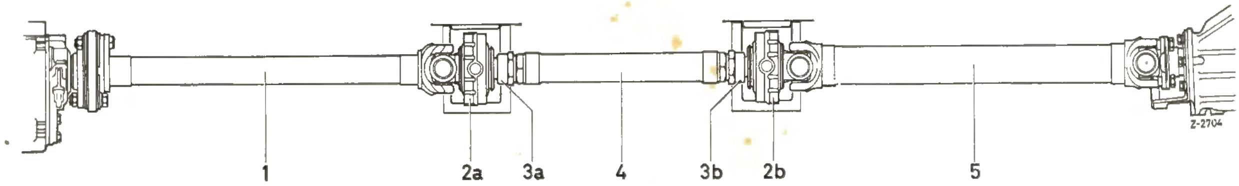


Fig. 41-1/13 Three-part propeller shaft

1 Front propeller shaft
2a, 2b Intermediate bearing
3a, 3b Clamp nut
4 Intermediate shaft
5 Rear propeller shaft

Removal:

When split two-part propeller shafts with clamp nut instead of the previous slip coupling are removed, the clamp nut (3) must be backed off; the individual parts of the propeller shaft can then be pushed together and pulled out of the centering on the transmission (Fig. 41-1/12).

In the case of the three-part propeller shaft only the front clamp nut (3a) on the intermediate shaft (4) need be backed off (Fig. 41-1/13).

To provide better access to the clamp nut on some models it may be necessary to remove the heat screening plate on the propeller-shaft housing above the propeller shaft.

Installation:

The clamp nut (3) or (3a and 3b) and the screws for the attachment of the intermediate bearing (2) or (2a and 2b) should not be fully tightened before the propeller shaft has been completely installed. The car must stand on its wheels in curb condition and must be pushed back and forward several times. This is the only way to cause the propeller shaft to adjust to its proper length and to guarantee correct installation without forcing.

Before tightening the clamp nuts (3a and 3b) on the intermediate shaft of the three-part propeller shaft take care to ensure that the intermediate shaft (4) does not knock against either the front or the rear intermediate bearing. The intermediate shaft must have the same distance at both ends from the intermediate bearings (for tightening torque of clamp nut see Job No. 41-0).

The propeller shafts with clamp nut are self-lubricating with the exception of the center cross of the front propeller shaft.

Brakes - Group 42

Brake System

General Data, Dimensions and Tolerances

Disk Brake

Modification: New models as from August 1965 added

Friction Pads

Model	Brake Caliper Make	Location	Part. No. Friction Pad Repair Set	Color Code	Lining Designation	Version
190 c 190 Dc 200, 200 D 230[1])	Teves	front axle	000 586 00 42	green-white	Fadil 77-79	1st
			000 586 06 42	green-green-white	Fadil 77-79 N 7	2nd
			000 586 19 42	green-yellow	Textar TP 25 D	repair version
220 b, 220 Sb 220 SEb, 230 SL 200, 200 D, 230, 230 S[1])	Girling	front axle	000 586 04 42	blue-blue-blue	Ferodo DS 5 S	1st
			000 586 10 42	blue-white	Ferodo DS 31	2nd
			000 586 20 42	green-yellow	Textar TP 25 D	repair version
300 SE	Dunlop	front axle	000 586 03 42	yellow-white	Ferodo DS 5 S	optional
			000 586 13 42	yellow-yellow-white	Fadil 77-75 N 7	
		rear axle	000 586 03 42	yellow-white	Ferodo DS 5 S	
			000 586 13 42	yellow-yellow-white	Fadil 77-79 N 7	
	Teves	front axle	000 586 05 42	blue-blue-blue	Ferodo DS 5 S	optional
			000 586 06 42	green-green-white	Fadil 77-79 N 7	
			000 586 19 42	green-yellow	Textar TP 25 D	
		rear axle	000 586 11 42	blue-blue-blue	Ferodo DS 5 S	optional
			000 586 14 42	green-green-white	Fadil 77-79 N 7	
			000 586 22 42	green-yellow	Textar TP 25 D	
	Dunlop	hand brake	000 586 02 42	red-yellow	DON 117	optional
				blue-white	Mintex M 34	
250 S, 250 SE 300 SEb 300 SEL	Teves	front axle	000 586 06 42	green-green-white	Fadil 77-79 N 7	optional
			000 586 19 42	green-yellow	Textar TP 25 D	
		rear axle	000 586 14 42	green-green-white	Fadil 77-79 N 7	
			000 586 22 42	green-yellow	Textar TP 25 D	

[1]) Models 200, 200 D, and 230 are equipped with either Teves or Girling brake calipers.

	Thickness of friction pad with back plate	Thickness of back plate	Permissible brake line wear down to a lining thickness of
Teves	15	5	2
Girling	16	5.5	2
Dunlop (service brake)	17	—	6
Dunlop (hand brake)	14	2	4.5[2])

[2]) Measured at the thinnest point.

Tightening Torques

<table>
<tr><td colspan="2">Hexgon socket screws for fastening the brake disk to the front wheel hub</td><td>11.5 mkg</td></tr>
<tr><td colspan="2">Hexagon fitted screws for fastening the caliper to the steering knuckle bracket</td><td>11.5 mkg</td></tr>
<tr><td rowspan="2">Hexagon fitted screws for fastening the brake caliper to the rear axle bearing housing or the bearing housing of the brarke support</td><td>300 SE</td><td>6.5 mkg</td></tr>
<tr><td>250 S, 250 SE, 300 SEb, 300 SEL</td><td>11.5 mkg</td></tr>
<tr><td colspan="2">Hexagon socket screws for fastening the brake disk and the wheel fixing disk to the rear axle shaft</td><td>13.5 mkg</td></tr>
<tr><td colspan="2">Hexagon screws (swing bolts) for fastening the hand brake caliper to the brake caliper</td><td>4.7 mkg</td></tr>
</table>

Adjustment of Hand Brake

<table>
<tr><th>Model</th><th>Version</th><th>Total transmission ratio of the hand brake</th><th>Number of notches on the ratchet</th><th>Number of notches required for setting the hand brake with medium-strong pull</th></tr>
<tr><td>220 b, 220 Sb,
220 SEb Sedan
1st version</td><td>Malleable-iron brake shoes without relay lever</td><td>1 : 85.7</td><td>22</td><td rowspan="2">approx. 12—13</td></tr>
<tr><td>220 SEb Cp
Intermediate version</td><td>Malleable-iron brake shoes with automatic adjustment and relay lever</td><td>1 : 89.5</td><td>22</td></tr>
<tr><td rowspan="3">190 c, 190 Dc
1st version,
220 b, 220 Sb,
220 SEb 2nd version</td><td rowspan="3">Light-metal brake shoes with relay lever</td><td rowspan="3">1 : 140</td><td>22</td><td rowspan="2">approx. 17—18</td></tr>
<tr><td>20</td></tr>
<tr><td>10</td><td rowspan="4">approx. 5—6</td></tr>
<tr><td rowspan="3">190 c, 190 Dc
2nd version
220 b, 220 Sb,
220 SEb 3rd version</td><td rowspan="3">Malleable-iron brake shoes with relay lever</td><td rowspan="3">1 : 102</td><td>10</td></tr>
<tr><td>12</td></tr>
<tr><td>16</td></tr>
<tr><td>230 SL</td><td>Malleable-iron brake shoes</td><td>1 : 77.25</td><td>6[1])</td><td>approx. 3—4[1])</td></tr>
<tr><td rowspan="2">300 SE</td><td rowspan="2">Disk brake</td><td rowspan="2">1 : 243</td><td>10</td><td rowspan="2">approx. 5—6</td></tr>
<tr><td>12</td></tr>
<tr><td>250 S, 250 SE
300 SEb, 300 SEL</td><td>Duo servo brake</td><td>1 : 33.5[2])</td><td>16</td><td>approx. 5—6</td></tr>
</table>

[1]) Number of notches on toothed segment.
[2]) Up to and of expansion lock.

Master Cylinder

Modification: 2nd Version Master Cylinder (Addition)

Job No.
42-3

A. General

The design and function of the master cylinder with its transparent plastic fluid reservoir is the same for all models. The only difference is that the master cylinder installed together with the ATE Power Brake has a larger cylinder diameter and is equipped in some cases with a special check valve. The 1st version master cylinder installed on Models 220 Sb and 220 SEb together with ATE Power Brake T 50/24 maintains a certain residual pressure in the whole hydraulic brake system by means of its check valve.

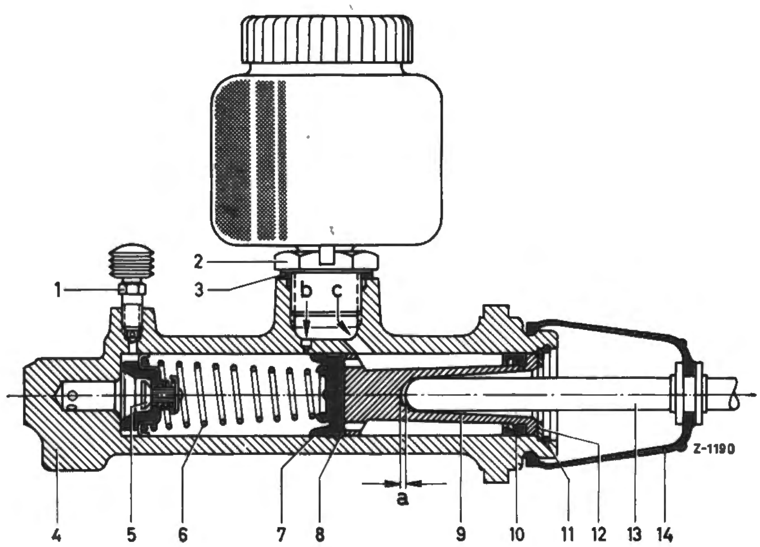


Fig. 42-3/1

1 Bleed screw
2 Tubular screw
3 Sealing ring
4 Housing
5 Check valve
6 Pressure spring
7 Primary cup
8 Piston cup washer
9 Piston
10 Secondary cup
11 Piston stop ring
12 Piston stop washer
13 Piston push rod
14 Boot
a = Clearance between piston and push rod (for dimensions see Job No. 42-0)
b = Compensating ports
c = Connecting ports

The 2nd version master cylinder which is installed together with ATE Power Brake T 50/24/1 has a special check valve with a 0.7 mm bore. This check valve installed in the hydraulic slave cylinder of ATE Power Brake T 50/24/1 maintains the residual pressure in the brake system. As a result of this arrangement of the check valve the hydraulic system of the ATE Power Brake and the line from the cylinder chamber of the master cylinder to the power brake is not under pressure when the brake system is in the non-applied position.

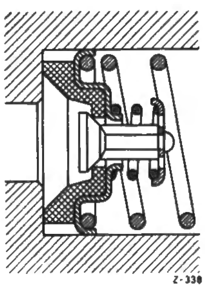
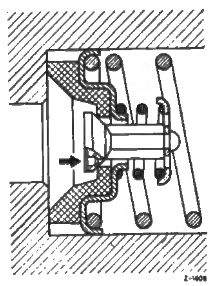


Fig. 42-3/2



Check valve in 1st version master cylinder ATE Power Brake T 50/24

Check valve in 2nd version master cylinder for ATE Power Brake T 50/24/1 and for cars with disk brake

The 2nd version master cylinder with special check valve is also installed in vehicles equipped with disk brakes since disk brake systems do not operate with residual pressure. In order to maintain the necessary residual pressure for the drum brakes on the rear axle a primary pressure valve has been installed in the line to the rear wheel brakes.

As a result the 2nd version master cylinder with special check valve must only be installed together with the ATE Power Brake T 50/24/1 in cars equipped with disk brakes.

In the case of Model 220 SEb with right-hand drive the fluid reservoir is separated from the master cylinder and the two are connected by a pipe.

B. Removal and Installation of Master Cylinder

Removal:

1. Drain the master cylinder via the opened bleed screw (4). Disconnect brake lines and stop light switch at the master cylinder (Fig. 42-3/4).

Note: In the case of cars with disk brakes on the front axle first disconnect the brake line at the primary pressure valve and then unscrew the primary pressure valve on the master cylinder.

2. Unscrew the master cylinder at the intermediate flange and at the cowl.

Installation:

3. When installing the master cylinder make sure that the stop light swich cannot be screwed in down to the end of the thread since the conical thread must provide a tight seal.

Note: In the case of cars equipped with disk brakes reattach the primary pressure valve to the master cylinder.

4. Adjust the brake pedal free play (see Job No. 42-20, Section B).

5. Bleed the brake system and check to make sure that there are no leaks and that the system is in good working order.

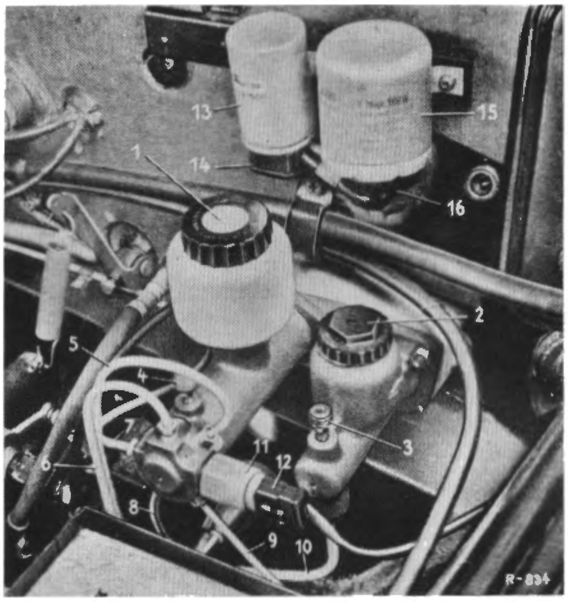


Fig. 42-3/4

1 Screw cap (master cylinder)
2 Screw cap (supply cylinder)
3 Bleed screw (supply cylinder)
4 Bleed screw (master cylinder)
5 Brake line
6 Brake line
7 Brake line
8 Brake line
9 Brake line
10 Line from supply cylinder to extraction cylinder
11 Stop light switch
12 Plug connection
13 Flash signal mechanism
14 Plug connection
15 Upper beam flash mechanism
16 Plug connection

C. Disassembly, Checking, and Reassembly of Master Cylinder

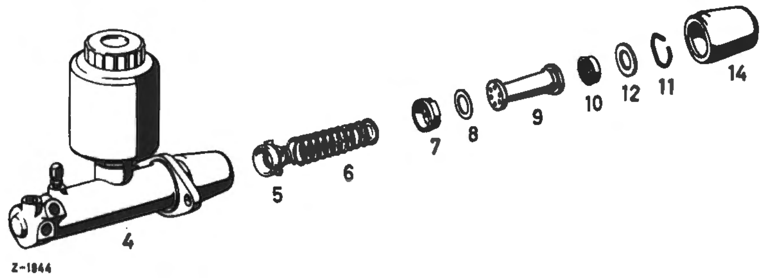


Fig. 42-3/5

4 Master cylinder
5 Check valve
6 Pressure spring
7 Primary cup
8 Piston cup washer
9 Piston
10 Secondary cup
11 Piston stop ring
12 Piston stop washer
14 Boot

Disassembly:

1. Screw out the fluid reservoir and the bleed screw from the master cylinder.

Note: Since on cars with right-hand drive and gasoline injection engines, fluid reservoir and master cylinder are separated, the hollow screw will have to be screwed out of this type of master cylinder.

2. Remove the boot (14) from the master cylinder (4) (see Fig. 42-3/5).

3. Use a screw driver to pry out the piston stop ring (11) from the groove in the brake master cylinder and remove the piston stop washer (12) (Fig. 42-3/5).

4. Pull out the piston (9) together with the secondary cup (10). Then remove the piston cup washer (8), the primary cup (7), the pressure spring (6) and the check valve (5) (Fig. 42-3/5).

5. Thoroughly clean all parts with alcohol or brake fluid.

Checking:

6. Check the bore in the master cylinder. The bore must be free from scoring or rust. Check the bore for conicity (for measurements see Job No. 42-0).

7. Check the compensating port (b) and the connecting port (c) for free passage (see Fig. 42-3/1).

   Clean the compensating port with a steel wire of approx. 0.5 mm ⌀ with a well-rounded end (see Fig. 42-3/1).

8. Check the piston for scoring and wear (for measurements see Job No. 42-0).

9. Clean the connecting ports in the piston.

10. Check the pressure spring.

Reassembly:

11. The bore in the brake master cylinder, the piston and all new cups should be oiled with brake fluid or given a light coat of ATE blue brake paste. Apply the paste sparingly to prevent plugging of the bores.

Note: In reassembling the brake master cylinder always use new cups and a new check valve.

12. Put the check valve on the pressure spring (see Fig. 42-3/5).

Note: Make sure that the special check valve with through-bore is installed in the master cylinder if the car is equipped with power brakes T 50/24/1 or T 50/26.

The sealing cone of the special check valve has a through-bore in the axial direction and the check valve does not therefore maintain any residual pressure. However, this special check valve makes it possible to supply additional brake fluid through the master cylinder.

13. Install the pressure spring together with the check valve in the cylinder.

14. Install a new primary cup (7) and the piston cup washer (8) in the cylinder (Fig. 42-3/5).

15. Install a new secondary cup in the piston and slide the piston into the bore of the master cylinder.

Note: Under no circumstances must the lip of the secondary cup be pressed in by means of a sharp object since it would be damaged in the process.

In order to facilitate installation, it is advisable to use a steel wire of approx. 1 mm ⌀ with a well-rounded end. Apply the steel wire to the cylinder bore at an angle and move it back and forth a number of times around the circumference. The pressure exerted on the piston should only be slight.

The secondary cup (1 a), previously installed in the main cylinder, has been replaced by a groove-ring cup (2 a). Since the groove-ring cup is considerably wider than the previous secondary cup, the piston (2) is provided with a wider groove. It is necessary therefore to make sure that pistons of the new version (with wider groove) are never provided with a secondary cup. Pistons of the prevous version cannot be used together with the new groove-ring cup because of the considerable difference in width (Fig. 42-3/6).

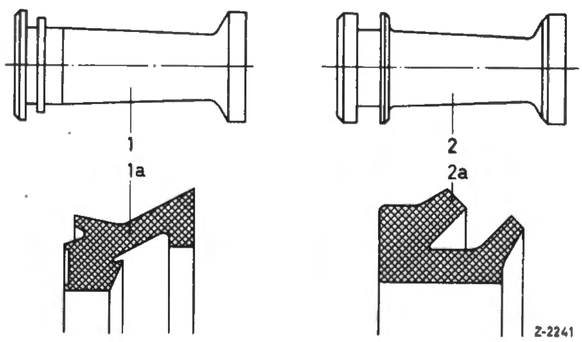


Fig. 42-3/6

1 Piston for secondary cup
1a Secondary cup
2 Piston for groove-ring cup
2a Groove-ring cup

16. Install the piston stop washer (12) and the piston stop ring (11) (Fig. 42-3/5).

17. Slide on the rubber boot.

18. Screw the fluid reservoir and the bleed screw into the master cylinder.

Note: On cars equipped with disk brakes the master cylinder has a larger fluid reservoir.

Job. No.
42-3a

Tandem Master Cylinder

A. General

Modification: 3rd version and new models August 1965 added

The tandem master cylinder is installed in cars which are equipped with a two-circuit brake system. The housing of the tandem master cylinder contains two pressure chambers which work independently of one another. If one brake circuit should develop a leak the tandem master cylinder ensures sufficient brake action in the remaining brake circuit.

In the 1st **version** of the tandem master cylinder the rear pressure chamber or the push rod circuit is connected to the front wheel brake and the front pressure chamber or floating circuit to the rear wheel brake (Fig. 42-3a/1).

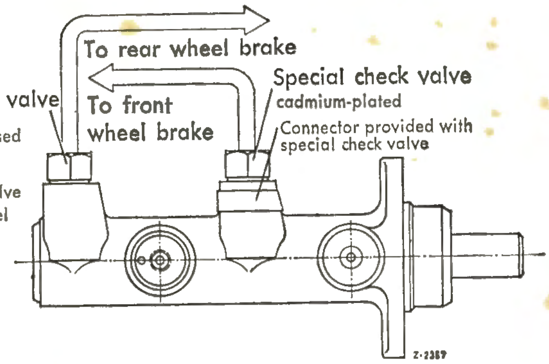


Fig. 42-3a/1

1st version

In the **2nd and 3rd versions** the rear pressure chamber is connected to the rear wheel brake and the front pressure chamber to the front wheel brake (Fig. 42-3a/2).

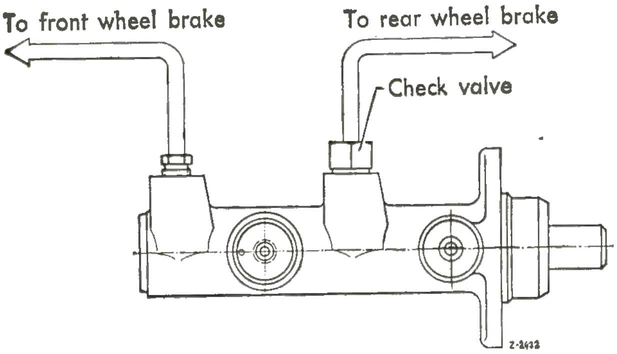


Fig. 42-3a/2

2nd and 3rd versions

On cars with drum brakes the connector on the tandem master cylinder for the brake line to the rear wheel brake is bonderised and on cars with disk brakes the connector is cadmium-plated.

Note: The 2nd version tandem master cylinder has been installed on cars with the following chassis end numbers:

	left-hand drive	right-hand drive
Model 190 c	106 922	107 477
Model 190 Dc	178 057	179 100
Model 220 b	064 207	063 880
Model 220 Sb	145 390	144 454
Model 220 SEb/sedan	072 639	071 887
Model 220 SEb/C	072 738	072 959
Model 230 SL	008 144	007 972
Model 300 SE	007 380	

3rd version tandem master cylinders were installed in Models 250 S, 250 SE, 300 SEb, and 300 SEL from the start.

The difference in the external appearance of the main cylinder is that the 2nd version has no special check valve for the front wheel brake and is provided with two connecting bores for the left and right front wheel brakes. Instead of the special check valve for the front wheel brake this version has been provided with calibrated bores (Figs. 42-3a/3/4).

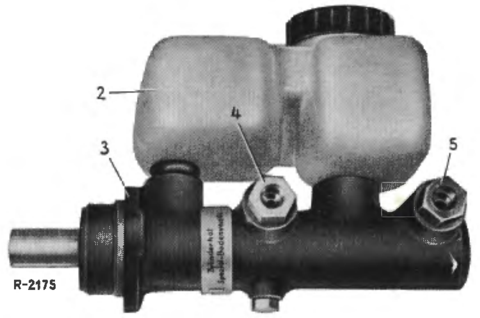


Fig. 42-3a/3

1st version

2 Reservoir
3 Housing
4 Special check valve
5 Check valve (special check valve on Modell 300 SE)

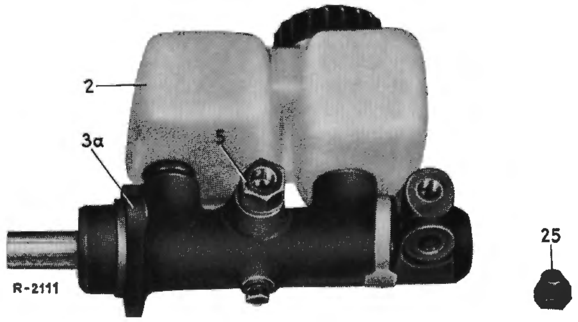


Fig. 42-3a/4

2nd and 3rd versions

2 Reservoir
3a Housing
5 Check valve (special check valve on models equipped **with disk brakes also on the rear axle**)
25 Screw plug with copper sealing ring

Note: If the first version tandem master cylinder is subsequently replaced by the 2nd or 3rd version the connection on the housing which points downward at an angle is closed by means of a screw plug (25) (Fig. 42-3a/4).

B. Construction

1st Version

The open end of the housing (22) contains the piston stop ring (5), the piston stop washer (4), the first vacuum seal (6), the spacer ring with drain groove, the second vacuum seal (6), and the support ring (8). The circular space between the two vacuum seals has a drain outlet via the leak port (13), so that no brake fluid can get into the power brake.

The piston (3) of the push rod circuit is provided with a piston cup washer (9) and primary cup (10). the thrust ring (11) engages the primary cup and is peened on the piston stem. The pressure spring (17) presses the piston against the support ring (8) via the spring retainer (12). The rear piston (3) is coupled to the intermediate piston (20) of the floating circuit by means of the connecting screw (14). A piston stop washer (13) is located between the spring retainer (12) and the intermediate piston. The intermediate piston carries the ring cups (18), which seal the two chambers of the tandem master cylinder off against one another, and in addition the piston cup washer (9) and the primary cup (10). The pressure spring (21) presses the intermediate piston against the stop screw (15) via the spring retainer (19). The housing carries the transparent reservoir (26), which is attached to the housing at the front by means of a hollow screw (25). Sealing is provided by an O-ring (23) and the reservoir plug (1). The reservoir is divided by a comparatively high partition so that each chamber has its own reservoir (Fig. 42-3a/5).

The push rod circuit lift is 19 mm and the floating circuit lift is 13 mm.

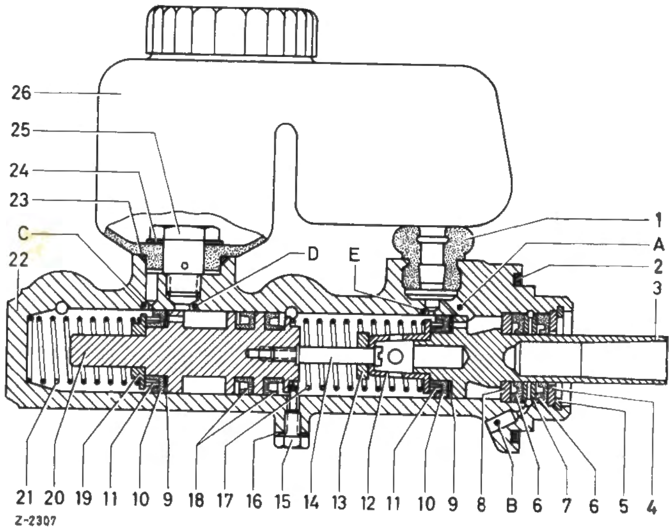


Fig. 42-3a/5

1 Plug
2 O-ring
3 Piston (push rod circuit)
4 Piston stop washer
5 Piston stop ring
6 Vacuum seal
7 Spacer ring
8 Support ring
9 Piston cup washer
10 Primary cup
11 Thrust ring
12 Spring retainer
13 Piston stop washer
14 Connecting screw
15 Stop screw for intermediate piston
16 Sealing ring (copper)
17 Pressure spring
18 Ring cup
19 Spring retainer
20 Intermediate piston (floating circuit)
21 Pressure spring
22 Housing
23 O-ring
24 Spring washer
25 Hollow screw
26 Reservoir

A Refill port (push rod circuit)
B Leak port
C Compensating port (floating circuit)
D Refill port (floating circuit)
E Compensating port (push rod circuit)

2nd Version

The 2nd version tandem master cylinder consists of the following parts:

The piston (3a) together with the piston cup washer (9a), the primary cup (10a), the thrust ring (11a) and the pressure spring (17a) with its spring retainer (12a). The intermediate piston (20a) is provided with two ring cups (18a) and like the piston (3a) with a piston cup washer (9a), a primary cup (10a), and a thrust ring (14a).

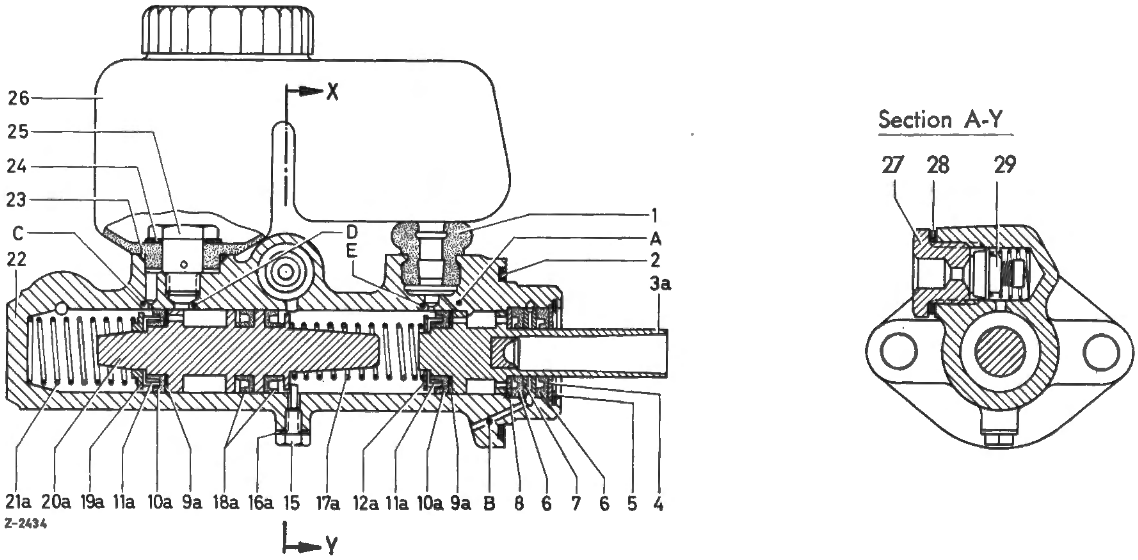


Fig. 42-3a/6

1 Plug
2 O-ring
3a Piston (push rod circuit)
4 Piston stop washer
5 Piston stop ring
6 Vacuum seal
7 Spacer ring
8 Support ring
9a Piston cup washer
10a Primary cup
11a Thrust ring
12a Spring retainer
15 Stop screw for intermediate piston
16a Sealing ring (copper)
17a Pressure spring
18a Ring cup
19a Spring retainer
20a Intermediate piston (floating circuit)
21a Pressure spring
22 Housing
23 O-ring
24 Spring washer
25 Hollow screw
26 Reservoir
27 Connector (bonderised on cars with drum brakes, cadmium-plated on cars with disk brakes)
28 Sealing ring
29 Check valve
A Refill port (push rod cicruit)
B Leak port
C Compensating port (floating circuit)
D Refill port (floating circuit)
E Compensating port (push rod circuit)

The arrangement of the pressure spring (21a) with spring retainer (19a), the stop screw (15), the support ring (8), the vacuum seals (6), the spacer ring (7), the piston stop washer (4), and the reservoir (26) is the same as in the first version. The piston (3a) and the intermediate piston (20a) are connected

via the rear pressure spring (17a). Since this pressure spring is weaker than the pressure spring (21a) the intermediate piston will only move when the pressure of the pressure spring (17a) has increased as a result of the piston movement to an extent when the initial tension of the pressure spring (21a) and the friction resistance of the cups has been overcome (Fig. 42-3a/6).

The push rod circuit lift is 12 mm and the floating circuit lift is 20 mm.

3rd Version

The construction of the 3rd version tandem master cylinder resembles that of the 1st version. The only difference is in the arrangement of the connecting screw (14) and spring retainer (12): the connecting screw is screwed into the piston (3) of the push rod circuit and the spring retainer is supported against the intermediate piston (20) of the floating circuit. The arrangement of the check valve (29) or the special check valve is the same as in the 2nd version master cylinder.

The push rod circuit lift is 13 mm and the floating circuit lift is 19 mm.

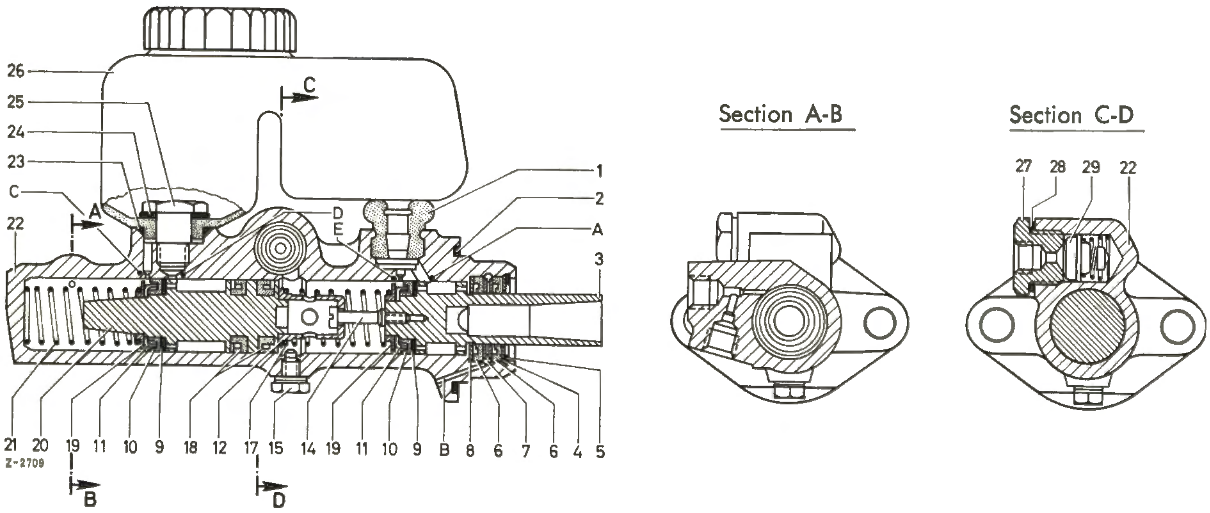


Fig. 42-3a/6a

1 Plug
2 O-ring
3 Piston (push rod circuit)
4 Piston stop washer
5 Piston stop ring
6 Vacuum seal
7 Spacer ring
8 Support ring
9 Piston cup washer
10 Primary cup
11 Thrust ring
12 Spring retainer
14 Connecting screw
15 Stop screw for intermediate piston
16 Sealing ring (copper)
18 Ring cup
19 Spring retainer
20 Intermediate piston (floating circuit)
21 Pressure spring
22 Housing
23 O-ring
24 Spring washer
25 Hollow screw
26 Reservoir
27 Connector (bonderised on cars with drum brakes, cadmium-plated on cars with disk brakes)
28 Sealing ring
29 Check valve or special check valve
A Refill port (push rod circuit)
B Leak port
C Compensating port (floating circuit)
D Refill port (floating circuit)
E Compensating port (push rod circuit)

C. Principle of Operation

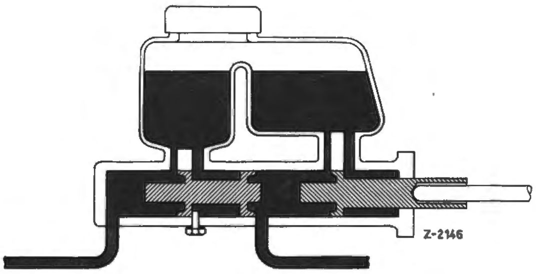


Fig. 42-3a/7

Tandem master cylinder in non-applied position

When the brake pedal is depressed, action is as follows:

1st and 3rd Versions Tandem Master Cylinder

The piston (3) and the intermediate piston (20) move forward together. It is only when the primary cup (10) passes beyond the compensating port (C) that pressure is built up in the two circuits. (The pressure spring (17) in the push rod circuit is considerably stronger than the spring (21) in the floating circuit. As a result, the two pistons move together until pressure has been built up in the front chamber) (Fig. 42-3a/5).

2nd Version Tandem Master Cylinder

At first the piston (3a) moves forward alone until the pressure of the weaker pressure spring (17a) is equal to the initial tension of the pressure spring (21 a) and also the friction resistance of the cups. After that the two pistons move together. Pressure for the brake circuits does not build up until the intermediate piston (20a) has passed beyond the compensating port (C) (Fig. 42-3a/6).

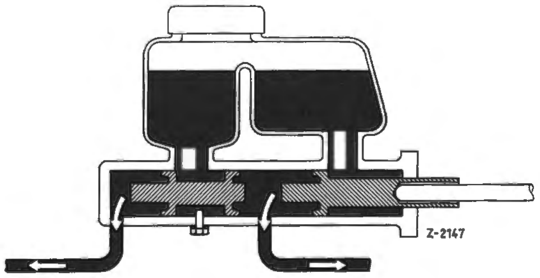


Fig. 42-3a/8

Both brake circuits in operation

If a leak should develop – e. g. in the brake circuit which is connected to the rear pressure chamber (brake hose burst, line worn through) – no pressure can build up in this pressure chamber, since the brake fluid will escape via the leak port.

On the 1st and 3rd versions tandem master cylinder the piston (3) will be moved forward until it rests against the intermediate piston (20) with its piston stop washer (13) and pushes the intermediate piston forward. Corresponding to the pedal load on the brake pedal and the servo support, pressure will now build up in the front pressure chamber which actuates the rear wheel brakes (Figs. 42-3a/5 and 9).

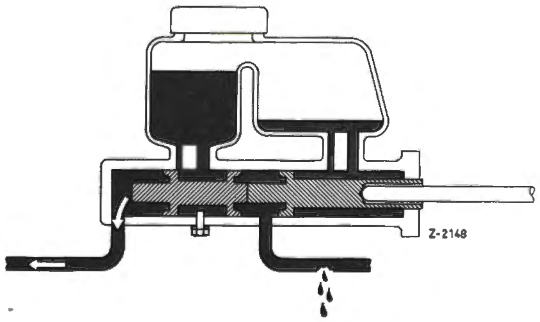


Fig. 42-3a/9

Leak in the brake circuit connected to the rear pressure chamber.

On the 2nd version the piston (3a) after overcoming the pressure of the pressure spring (17a) pushes the intermediate piston (20a) directly forward and produces the pressure in the brake circuit for the front wheel brake; the pressure depends on the pedal load and on the power brake (Figs. 42-3a/6 and 42-3a/9).

If a leak should develop in the brake circuit connected to the front pressure chamber, the two pistons will move forward until the head of the intermediate piston comes to rest against the housing wall. It is only now that pressure will build up in the rear pressure chamber which is then transmitted through the lines to the front wheel brake or the rear wheel brake (Figs. 42-3a/6 and 42-3a/10).

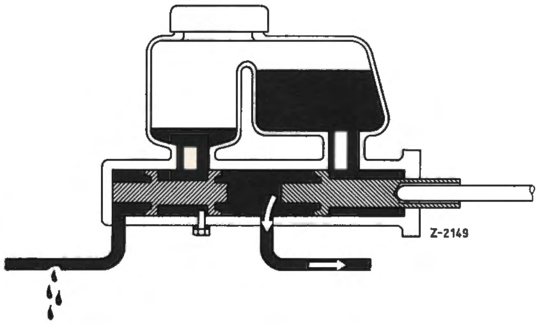


Fig. 42-3a/10

Leak in the brake circuit connected to the front pressure chamber.

Failure of any brake circuit is immediately noticeable because the brake pedal travel becomes considerably longer. This longer travel is due to the fact that when leakage occurs at a point in the brake circuit connected to the rear pressure chamber, the piston of the push rod circuit must be moved without producing any effect until it comes to rest against the intermediate piston (Fig. 42-3a/9).

When there is a failure of the brake circuit connected to the front pressure chamber, the intermediate piston of the floating circuit has to be moved without producing any effect until it comes to rest against the housing of the tandem master cylinder (Fig. 42-3a/10).

This means that whenever leakage occurs either in the front wheel or the rear wheel brake circuit, hydraulic pressure can build up in the still operative brake circuit only when the non-effective part of the piston travel has been overcome.

It goes without saying that braking action is correspondingly lower when one circuit is out of action. Reduced braking action is particularly noticeable when there is a failure in the front wheel brakes and the car can only be braked with the rear wheels.

D. Removal and Installation of Tandem Master Cylinder

Removal

1. On all models with the exception of Models 190 c, 200, and 230 SL remove the battery. On Models 300 SE, 300 SEb, and 300 SEL also remove the reservoir for the high pressure oil pump.

2. Pump the brake fluid out of the reservoir (2) via an opened bleed screw in the front wheel and rear wheel brake circuits, making sure that both chambers of the reservoir are emptied (Fig. 42-3a/11).

3. In the case of the 1st version tandem master cylinder detach the brake lines (9) and (10) from the master cylinder (Figs. 42-3a/11 and 42-3a/12).

   In the case of the 2nd and 3rd version tandem master cylinder detach both brake lines to the front wheel brake and the brake line to the rear wheel brake.

   On cars with a common reservoir (2) for the brake system and the hydraulic clutch actuction, detach the connecting hose (22) between the reservoir and the feed line of the supply cylinder (Fig. 42-3a/16).

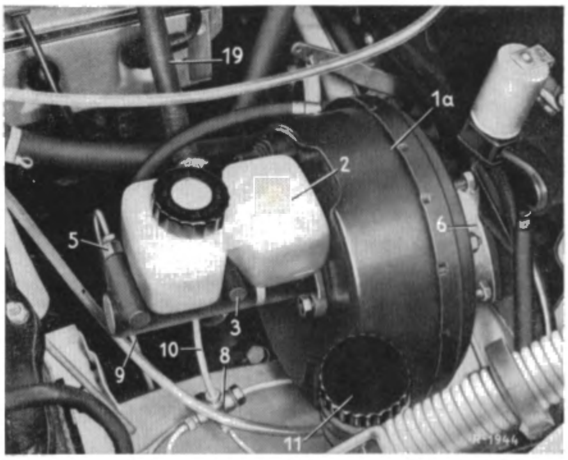


Fig. 42-3a/11

Arrangement on Models 190 c and 190 Dc, 1st version

1a Power brake T 51/100
2 Reservoir
3 Tandem master cylinder
5 Residual pressure valve
6 Intermediate flange
8 Distributor fitting
9 Brake line to rear wheel brake
10 Brake line to distributor fitting
11 Reservoir for supply cylinder
19 Vacuum hose

Note: Close the brake lines by means of the rubber cups of the bleed screws, and the tandem master cylinder connections by means of dummy plugs.

4. Detach the tandem master cylinder (3) from the power brake (1) and remove, paying attention to the O-ring (10) located in the groove of the tandem master cylinder (Fig. 42-3a/13).

Installation:

If the 1st version tandem master cylinder is replaced by the 2nd or 3rd version (with the brake circuits connected the other way round) the brake line (10) to the distributor fitting (8) of the front wheel brake should be connected to the floating circuit pressure chamber and the brake line (9) to the rear wheel brake should be connected to the push rod pressure chamber. The second connection on the master cylinder which points downward should be closed with a screw plug (25) and a copper sealing ring Part No. 000 997 50 30 (Fig. 42-3a/12).

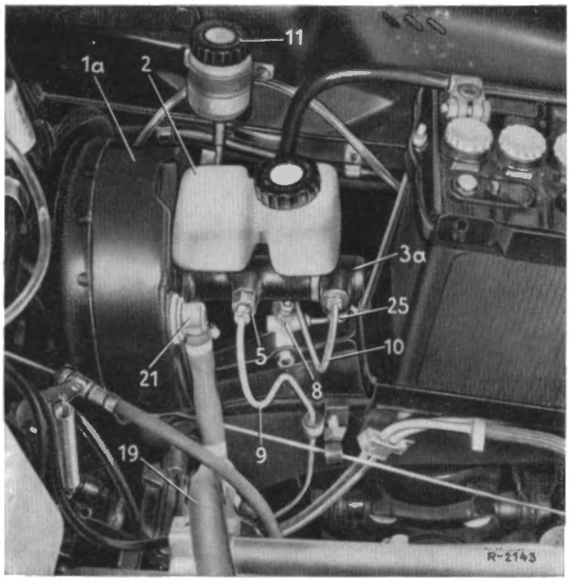


Fig. 42-3a/12

1a Power brake T 51/100
2 Reservoir
3a Tandem master cylinder
5 Connector
8 Distributor fitting
9 Brake line to rear wheel brake
10 Brake line to front wheel brake distributor fitting
11 Reservoir for supply cylinder
19 Vacuum hose
21 Right-angle connector
25 Screw plug

5. Make sure that the leak port in the flange of the master cylinder is not clogged since this leak port serves to provide a drain via the vacuum cup of the rear piston for any brake fluid that may escape and thus prevents brake fluid from getting into the power brake.

6. Clean the sealing surface on the front of the power brake.

7. Put the O-ring (10) in the groove and attach the tandem master cylinder (5) to the power brake (1). Tighten the hexagon nuts with a torque of 1.8–2 mkg (Fig. 42-3a/13).

Note: Always replace the O-ring since the connection between the tandem master cylinder and the power brake must always be completely vacuum-tight.

8. Attach the brake lines to the tandem master cylinder and the vacuum hose to the power brake.

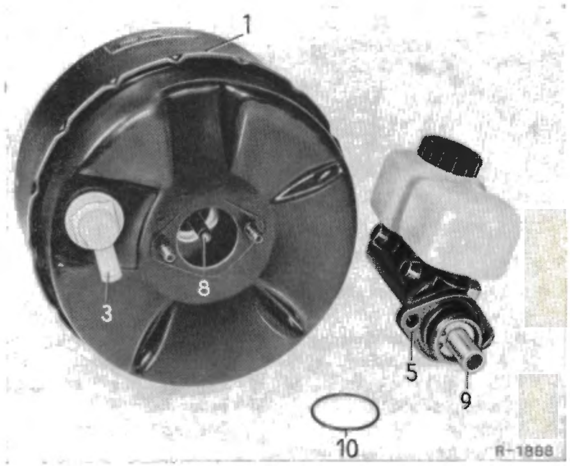


Fig. 42-3a/13

1 Power brake
3 Check valve
5 Tandem master cylinder
8 Push rod of power brake
9 Piston (push rod circuit)
10 O-ring

Note: Please make sure that on cars with drum brakes the brake line to the rear wheel brake is attached to the check valve of the tandem master cylinder. In order to provide identification of the check valve and special check valve on the 1st version master cylinder the valves have been marked as follows: **Check valve bonderised (dark gray), special check valve cadmium-plated.**

On the second or third version master cylinder the connector is bonderised when a check valve is installed and it is cadmium-plated when a special check valve is installed.

9. Fill the reservoir with brake fluid, making sure that both chambers are completely filled. Bleed the brake system and check for leaks.

Note: If the system is bled without a bleeding device, the relevant bleed screw must always be closed before the brake lever is released. This prevents air from being sucked in via the thread of the bleed screw.

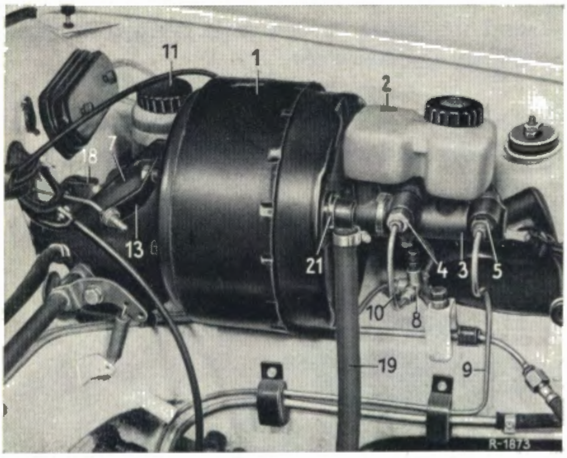


Fig. 42-3a/14

Arrangement on Model 230 SL

1 Power brake T 51/200
2 Reservoir
3 Tandem master cylinder
4 Special check valve
5 Check valve
7 Bearing bracket
8 Distributor fitting
9 Brake line to rear wheel brake
10 Brake line to distributor fitting
11 Reservoir for supply cylinder
13 Bracket for oil pressure gage
18 Piston rod for power brake
19 Vacuum hose
21 Right-angle connector

10. Whenever the battery or the reservoir for the high-pressure pump was removed, reinstall the battery or the reservoir.

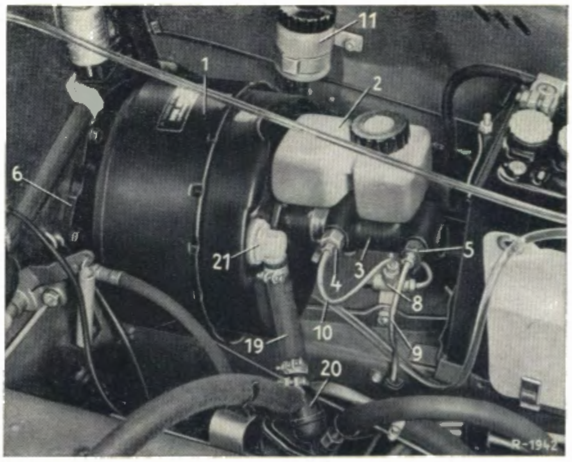


Fig. 42-3a/15

Arrangement on Models 220 b, 220 Sb, 220 SEb

1 Power brake T 51/200
2 Reservoir
3 Tandem master cylinder
4 Special check valve
5 Check valve
6 Intermediate flange
8 Distributor fitting
9 Brake line to rear wheel
9 Brake line to rear wheel brake
10 Brake line to distributor fitting
11 Reservoir for supply cylinder
19 Vacuum hose
20 Evaporator jar
21 Check valve

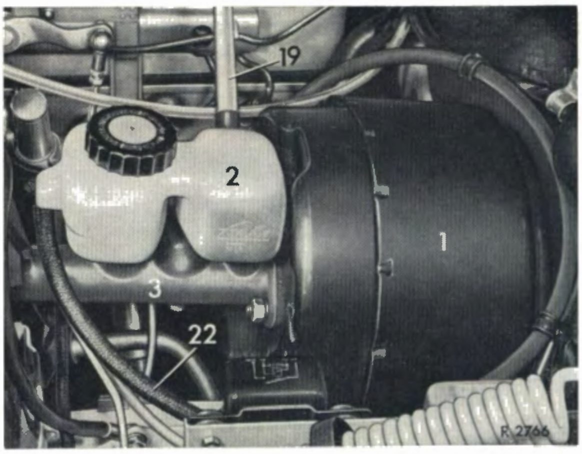


Fig. 42-3a/16

Arrangement on Models 300 SEb and 300 SEL

1 Power brake T 51/200
2 Reservoir
3 Tandem master cylinder
19 Vacuum hose
22 Connecting hose to supply cylinder

E. Disassembly, Checking and Reassembly of Tandem Master Cylinder

1st Version

Disassembly:

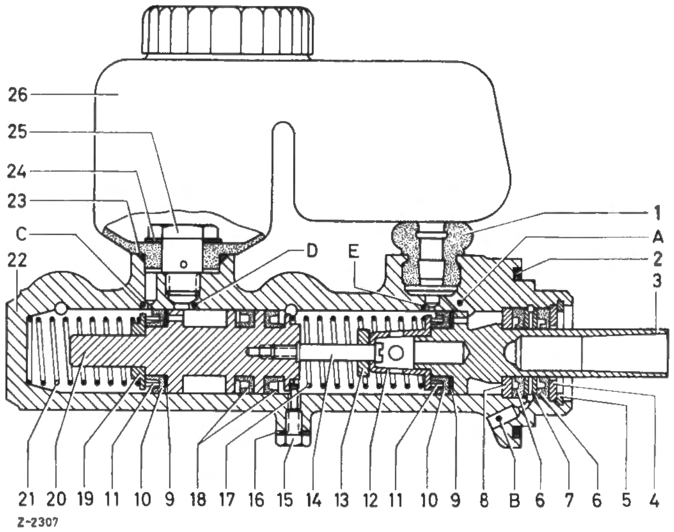


Fig. 42-3a/17

1 Plug
2 O-ring
3 Piston (push rod circuit)
4 Piston stop washer
5 Piston stop ring
6 Vacuum seal
7 Spacer ring
8 Support ring
9 Piston cup washer
10 Primary cup
11 Thrust ring
12 Spring retainer
13 Piston stop washer
14 Connecting screw
15 Stop screw for intermediate piston
16 Sealing ring (copper)
17 Pressure spring
18 Ring cup
19 Spring retainer
20 Intermediate piston (floating circuit)
21 Pressure spring
22 Housing
23 O-ring
24 Spring washer
25 Hollow screw
26 Reservoir

A Refill port (push rod circuit)
B Leak port
C Compensating port (floating circuit)
D Refill port (floating circuit)
E Compensating port (push rod circuit)

1. Unscrew the hollow screw (25) from the housing (22) and remove together with the spring washer (24) (Figs. 42-3a/17 and 42-3a/18).

2. Lift the reservoir (26) out of the plug (1) and remove the O-ring (23) from the housing (Fig. 42-3a/17).

3. Unscrew the check valve and the special check valve from the housing.

Note: The tandem master cylinder for Model 300 SE has two special check valves.

4. Slightly depress the piston (3) with a drift (31), unscrew the stop screw (15) from the housing and remove together with the sealing ring (16) (Figs. 42-3a/17 and 19).

5. Remove the piston stop ring (5) from the housing, slightly depressing the piston with the drift in the process. Then take the piston out of the housing together with the piston stop washer (4), the two vacuum seals (6), the spacer ring (7) and the support ring (8) (Figs. 42-3a/17 and 42-3a/21).

Note: On the 1st series of tandem master cylinders the thrust ring (11) was loose on the piston (3). On later cylinders the thrust ring was peened on the piston in such a way that the primary cup (10) and the piston cup washer (9) can no longer be removed from the piston.

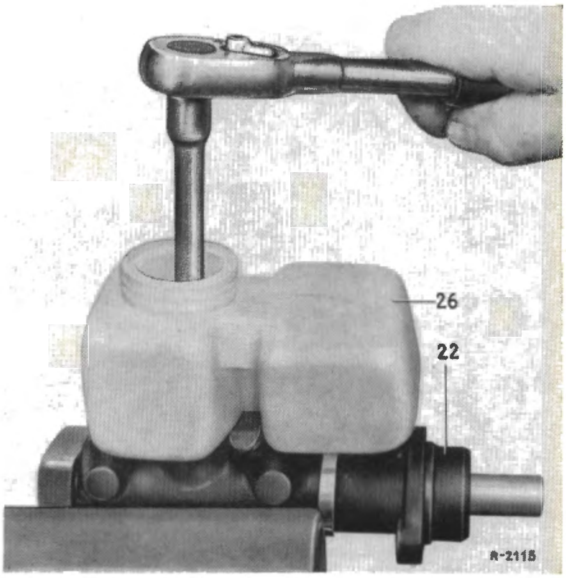


Fig. 42-3a/18

22 Housing of tandem master cylinder
26 Reservoir

42-3a/9

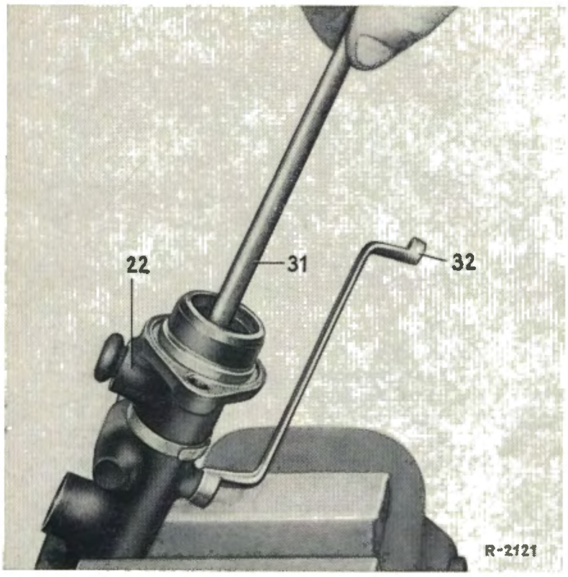


Fig. 42-3a/19

22 Housing of tandem master cylinder
31 Drift
32 Box wrench

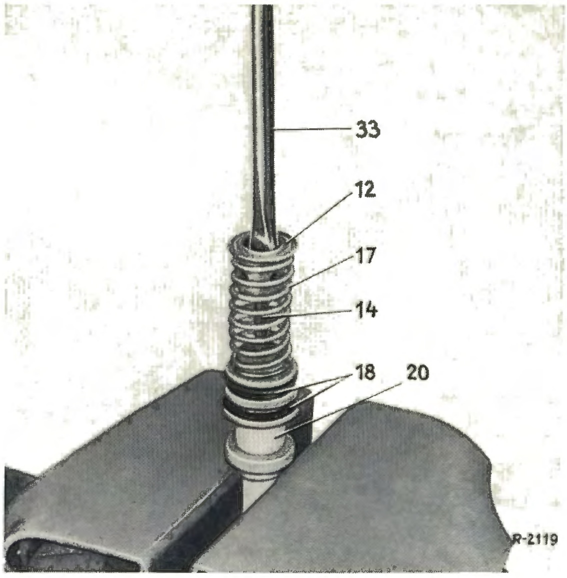


Fig. 42-3a/20

12 Spring retainer
14 Connecting screw
17 Pressure spring
18 Ring cup
20 Intermediate piston
33 Screwdriwer

6. Knock out the intermediate piston (20) assembly by lightly knocking the housing on a piece of wood.

7. Unscrew connecting screw (14) from the intermediate piston (20) and remove the piston stop washer (13), the spring retainer (12), and the pressure spring (17) (Figs. 42-3a/20 and 42-3a/21).

Checking:

8. Thoroughly clean all parts in methylated spirits.

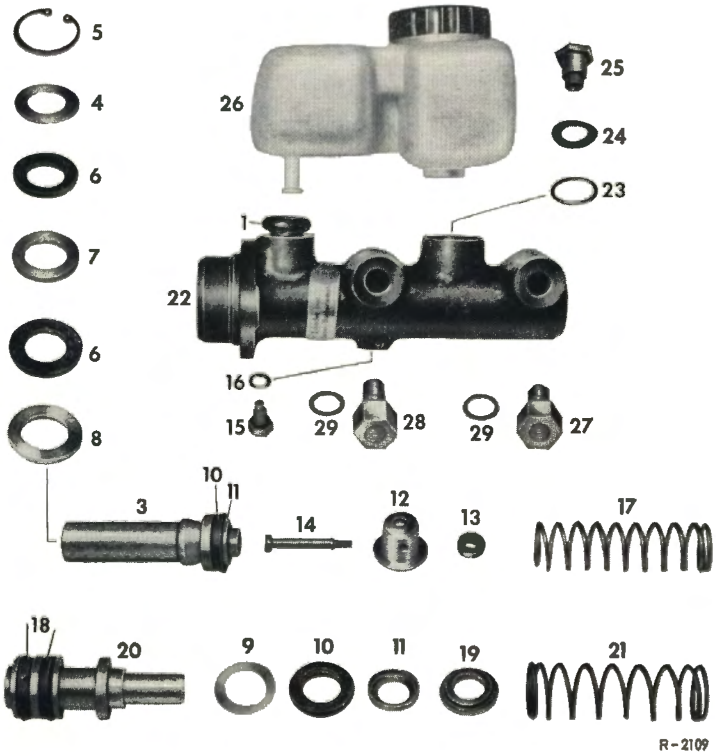


Fig. 42-3a/21

1 Plug
3 Piston (push rod circuit)
4 Piston stop washer
5 Piston stop ring
6 Vacuum sealing ring
7 Spacer ring
8 Support ring
9 Piston cup washer
10 Primary cup
11 Thrust ring
12 Spring retainer
13 Piston stop washer
14 Connecting screw
15 Stop screw for intermediate piston
16 Sealing ring (copper)
17 Pressure spring
18 Ring cup
19 Spring retainer
20 Intermediate piston (floating circuit)
21 Pressure spring
22 Housing
23 O-ring
24 Spring washer
25 Hollow screw
26 Reservoir
27 Check valve (special check valve on Model 300 SE)
28 Special check valve
29 Sealing ring

9. Check the bore in the housing for scores and corrosion. Rust marks may be removed with polishing cloth. **Scored or rusty housings must not be repaired; install a new tandem master cylinder.**

Reassembly:

10. Screw the connecting screw (14) into the intermediate piston (20) together with the piston stop washer (13), the pressure spring (17) and the spring retainer (12) (Figs. 42-3a/20 and 22).

Note: Do not leave out the piston stop washer (13) which is a stroke limitation for the piston of the push rod circuit (Fig. 42-3a/17).

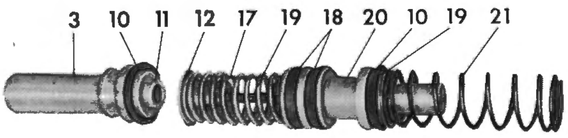


Fig. 42-3a/22

3 Piston (push rod circuit)
10 Primary cup
11 Thrust ring
12 Spring retainer
17 Pressure spring
18 Ring cup
19 Spring retainer
20 Intermediate piston (floating circuit)
21 Pressure spring

11. Clamp the housing in a vise in such a way that the bore points downward at an angle (Fig. 42-3a/23).

12. Insert the fitting sleeve (29) in the housing (22).

Note: The fitting sleeve can be made of light metal in the shop in accordance with the dimensions given in Fig. 42-3a/24.

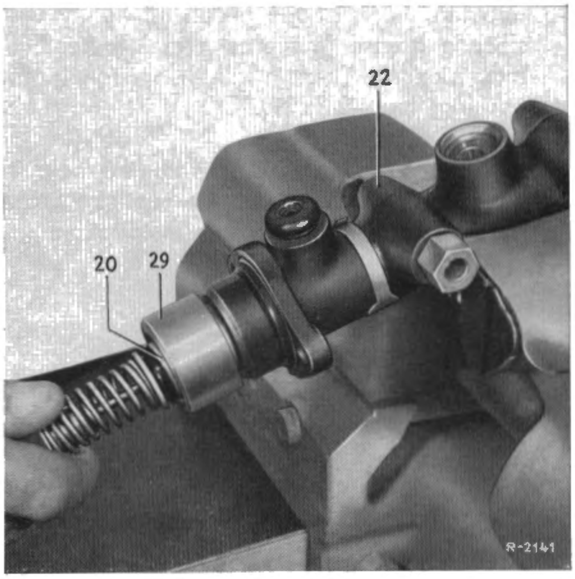


Fig. 42-3a/23

20 Intermediate piston
22 Housing of tandem master cylinder
29 Fitting sleeve

13. Slide the piston cup washer (9), the primary cup (10), the thrust ring (11), and the spring retainer (19) together with the pressure spring (21) on the intermediate piston. Lightly rub the primary cup (10) and the two ring cups (18) with ATE brake paste or brake fluid (Figs. 42-3a/17 and 21).

14. Slide the intermediate piston assembly (20) into the housing. **Do not use force** since otherwise the cups may be damaged (Fig. 42-3a/23).

Note: If no fitting sleeve is available the intermediate piston must be installed with utmost care, since the cup might easily be damaged. (Move piston end in a circle).

15. Clamp the master cylinder in a vise in such a way that the bore points upward. Depress the intermediate piston with the drift (31) until it reaches the stop in the housing (32); then screw the stop screw (15) with a new copper sealing ring (16) into the housing (Figs. 42-3a/17 and 42-3a/19).

16. Rub the shank of the piston (3) lightly with silicone grease (manufacturers Wacker-Chemie, Munich). Then install the piston in the housing (Fig. 42-3a/19).

Note: Install also this piston with the help of the fitting sleeve and rub the cup with brake paste or brake fluid before installation.

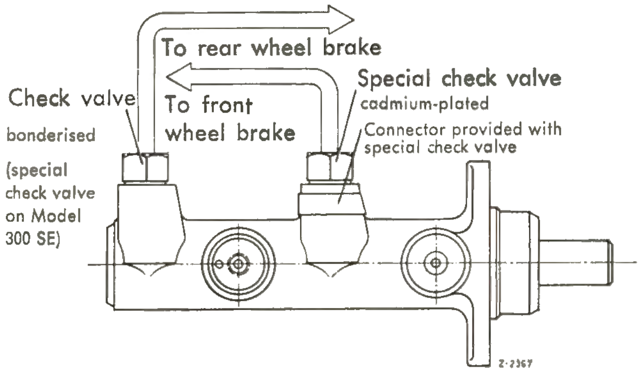


Fig. 42-3a/26

Arrangement of check valves

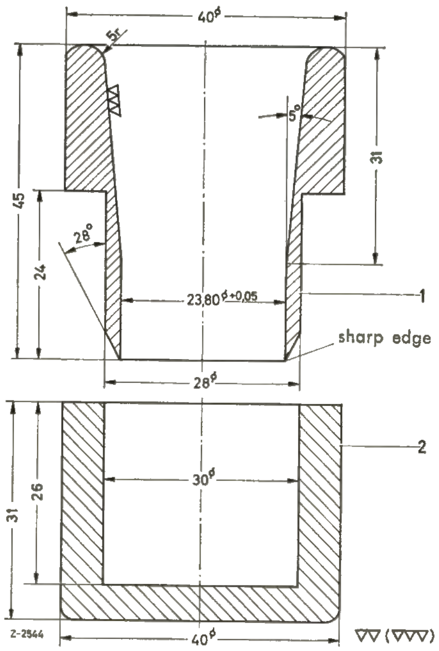


Fig. 42-3a/24

1 Fitting sleeve 2 Protective sleeve

17. First insert the support ring (8) in the housing (Fig. 42-3a/17). Then lightly rub the vacuum seals (6) with silicone grease and install one vacuum seal. Press the seal home with a blunt instrument. Now install the spacer ring (7) in such a way that the radial bore points toward the leak port (B). Then insert the second vacuum seal and the piston stop washer (4) together with the piston stop ring (5), at the same time pressing the piston lightly into the housing by means of a drift (Fig. 42-3a/25).

Note: The vacuum seal prevents brake fluid from overflowing into the vacuum cylinder of the power brake. The sealing lips must therefore point in the direction of the primary cup.

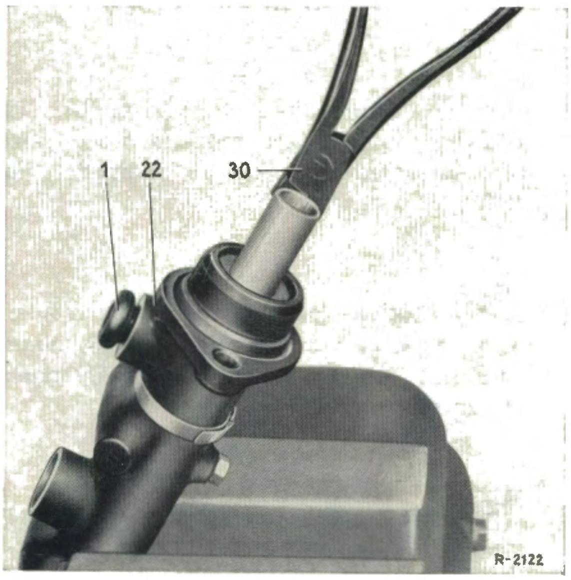


Fig. 42-3a/25

1 Plug
22 Housing
30 Locking pliers

18. Screw the check valve and the special check valve into the housing, using new copper sealing rings (Fig. 42-3a/26).

Note: Model 300 SE has two special check valves. For identification purposes the check valves are bonderised and the special check valves cadmium-plated.

19. Insert the O-ring (23) in the housing (22) and press the reservoir (26) into the plug (1). Then attach the reservoir to the master cylinder by means of the hollow screw (25) together with the spring washer (24) (Fig. 42-3a/17).

Note: Do not tighten the hollow screw too much since this would damage the thread in the housing.

2nd Version

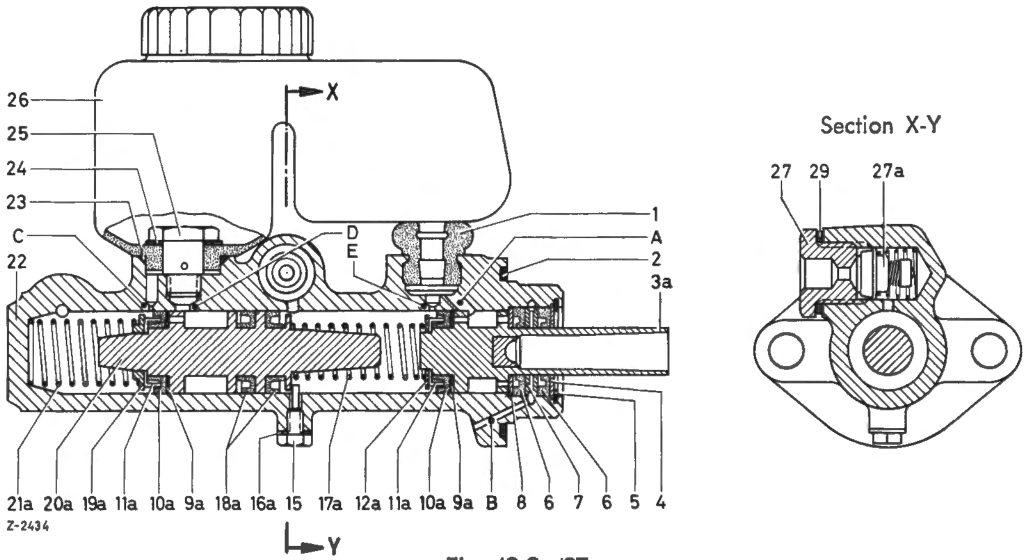


Fig. 42-3a/27

1 Plug
2 O-ring
3a Piston (push rod circuit)
4 Piston stop washer
5 Piston stop ring
6 Vacuum seal
7 Spacer ring
8 Support ring
9a Piston cup washer
10a Primary cup
11a Thrust ring
12a Spring retainer
15 Stop screw for intermediate piston
16a Sealing ring (copper)
17a Pressure spring
18a Ring cup
19a Spring retainer
20a Intermediate piston (floating circuit)
21a Pressure spring
22 Housing
23 O-ring
24 Spring washer
25 Hollow screw
26 Reservoir
27 Connector
27a Check valve with spring
29 Sealing ring

Disassembly:

1. Apart from a few details the disassembly operations for the tandem master cylinder are exactly as described in the previous paragraphs 1 to 6. On the 2nd version the check valve (27a) is separated from the connector (27) in the master cylinder (Figs. 42-3a/27 and 28).

Checking:

2. Thoroughly clean all parts in methylated spirits.

3. Check the bore in the housing for scores and corrosion. Rust marks may be removed with polishing cloth. **Scored or rusty housings must not be repaired; install a new tandem master cylinder.**

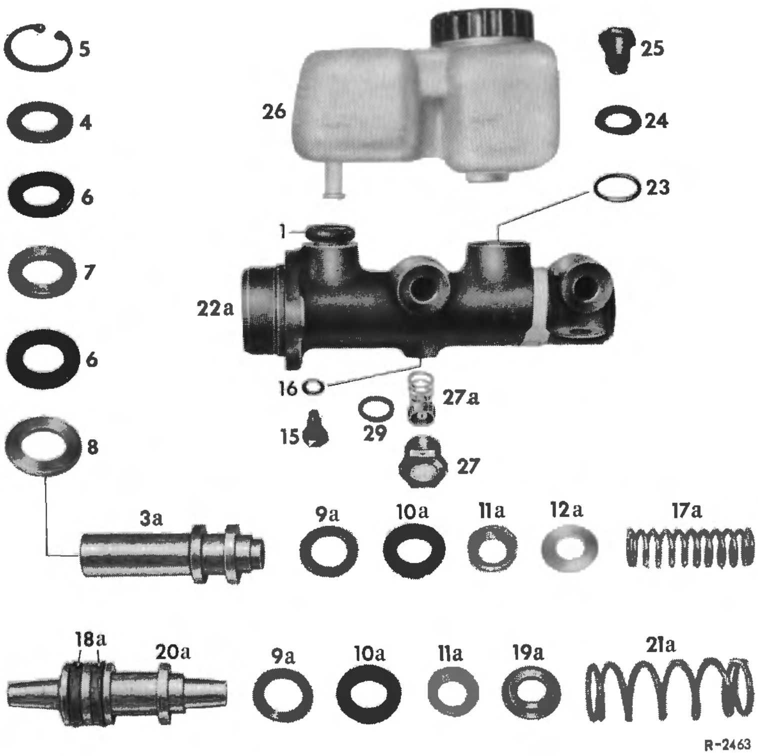


Fig. 42-3a/28

1 Plug
3a Piston (push rod circuit)
4 Piston stop washer
5 Piston stop ring
6 Vacuum sealing ring
7 Spacer ring
8 Support ring
9a Piston cup washer
10a Primary cup
11a Thrust ring
12a Spring retainer
15 Stop screw for intermediate piston
16a Sealing ring (copper)
17a Pressure spring
18a Ring cup
19a Spring retainer
20a Intermediate piston (floating circuit)
21a Pressure spring
22a Housing
23 O-ring
24 Spring washer
25 Hollow screw
26 Reservoir
27 Connector
27a Check valve with spring
29 Sealing ring

Reassembly:

4. Clamp the housing in a vise in such a way that the bore points downward at an angle (Fig. 42-3a/23).

5. Insert the fitting sleeve (29) in the housing (22) (Fig. 42-3a/28).

6. Lightly coat all cups of both pistons with ATE brake paste or brake fluid.

7. Slide the piston cup washer (9a), the primary cup (10a), the thrust ring (11a), and the spring retainer (19a) together with the pressure spring (21a) on the intermediate piston (20a). (Figs. 42-3a/27 to 29).

8. Slide the intermediate piston assembly (20a) into the housing. **Do not use force** since otherwise the cups may be damaged (Fig. 42-3a/29).

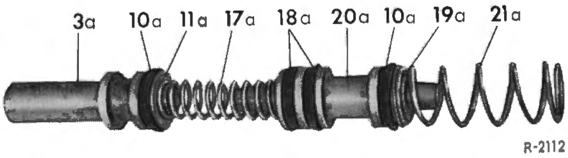


Fig. 42-3a/29

3a Piston (push rod circuit)	18a Ring cup
10a Primary cup	19a Spring retainer
11a Thrust ring	20a Intermediate piston
17a Pressure spring	21a Pressure spring

Note: If no fitting sleeve is available the intermediate piston must be installed with the utmost care, since the cup might easily be damaged. (Move piston end in a circle).

9. Clamp the master cylinder in a vise in such a way that the bore points upward. Depress the intermediate piston with the drift (31) until it reaches the stop in the housing (22); then screw the stop screw (15) with a new copper sealing ring (16) into the housing (see Fig. 42-3a/19).

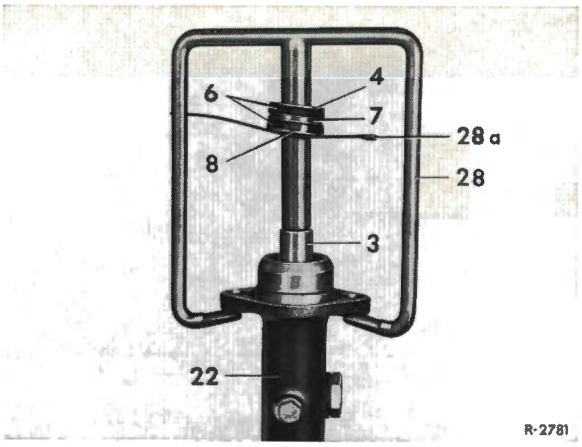


Fig. 42-3a/30

3 Piston	8 Support ring
4 Piston stop washer	22 Housing
6 Vacuum seal	28 Tensioning fixture
7 Spacer ring	28a Retaining wire

10. Lightly rub the shank of the piston (3a) with silicone grease and install the piston in the housing together with the pressure spring (17a) and the spring retainer (12a). Then remove the fitting sleeve (Figs. 42-3a/27 to 29).

11. Install in the proper order the support ring (8), one vacuum seal (6), the spacer ring (7), washer (4) and the piston stop ring (5) on the tensioning fixture (28). Then press the piston assembly into the housing by means of the tensioning fixture and engage the tensioning fixture in the fixing holes of the housing (Fig. 42-3a/30).

Note: The tensioning fixture can be made in the shop in accordance with the dimensions given in Fig. 42-3a/31. The retaining wire (3) holds the piston assembly to facilitate the positioning of the individual parts. The tensioning fixture shown in Fig. 42-3a/30 was not yet provided with such a retaining wire.

12. Install in the housing (22a) first the support ring (8), and then a vacuum seal (6), the spacer ring (7), the second vacuum seal (6) and the piston rod washer (4). If necessary press the vacuum seal into the housing with a blunt instrument. Finally insert the piston stop ring (5) (Fig. 42-3a/27).

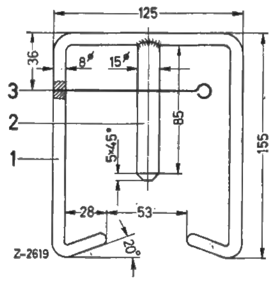


Fig. 42-3a/31

Tensioning fixture

1 Bracket 2 Drift 3 Retaining wire

Note: Lightly coat the sealing lips of the vacuum seal with silicone grease before installation. The sealing lips must point toward the primary cup.

13. Remove the tensioning fixture from the housing.

14. Install the check valve (27a) together with the spring in the housing in such a way that the rubber cap of the valve points toward the connector (27a). Then screw the connector into the housing together with a new copper sealing ring (29) (Figs. 42-3a/27 and 28).

Note: This version of the tandem master cylinder does not require a special check valve for the front wheel disk brake since the bores in the housing are calibrated.

On all models equipped with disk brakes on the rear axle, replace the standard check valve in the tandem master cylinder by a special check valve.

(Connector for check valve bonderised, connector for special check valve cadmium-plated).

15. Install the reservoir in the housing, for which see para 19 in the previous section.

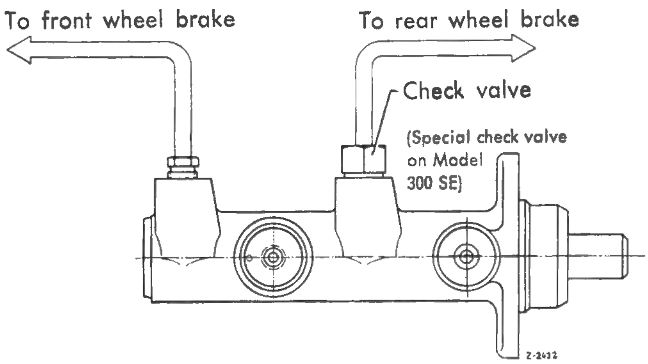


Fig. 42-3a/32

3rd Version

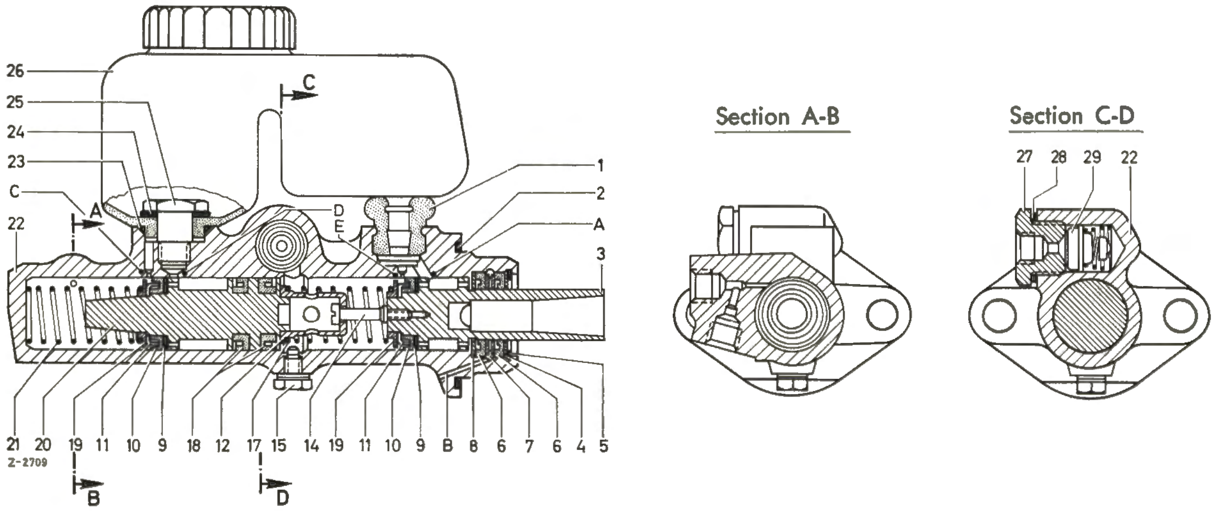


Fig. 42-3a/33

1 Plug
2 O-ring
3 Piston (push rod circuit)
4 Piston stop washer
5 Piston stop ring
6 Vacuum seal
7 Spacer ring
8 Support ring
9 Piston cup washer
10 Primary cup
11 Thrust ring
12 Spring retainer
15 Stop screw for intermediate piston
16 Sealing ring (copper)
17 Pressure spring
18 Ring cup
19 Spring retainer
20 Intermediate piston (floating circuit)
21 Pressure spring
22 Housing
23 O-ring
24 Spring washer
25 Hollow screw
26 Reservoir
27 Connector
28 Sealing ring
29 Check valve with spring

A Refill port (push rod circuit)
B Leak port
C Compensating port (floating circuit)
D Refill port (floating circuit)
E Compensating port (push rod circuit)

Disassembly:

1. Apart from a few details the disassembly procedures for the tandem master cylinder are exactly as described in paras 1-6 for the 1st version tandem master cylinder.

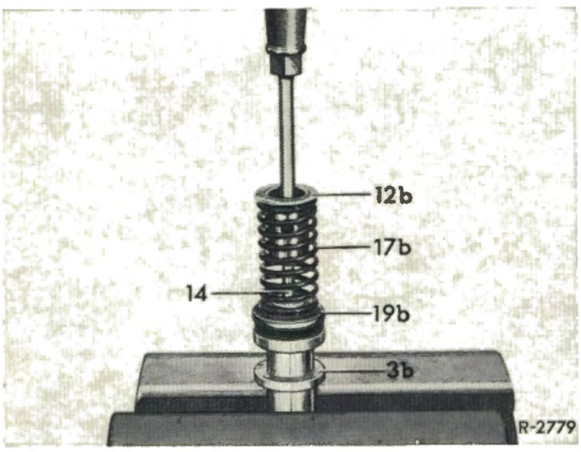


Fig. 42-3a/34

3b Piston
12b Spring retainer
14 Connecting screw
17b Pressure spring
19b Spring retainer

2. Unscrew the connecting screw (14) from the piston (3b) and remove the spring retainer (12b) together with the pressure spring (17b) (Fig. 42-3a/34).

Checking:

3. The procedures are identical with those described in the preceding sections for the 1st and 2nd version tandem master cylinders.

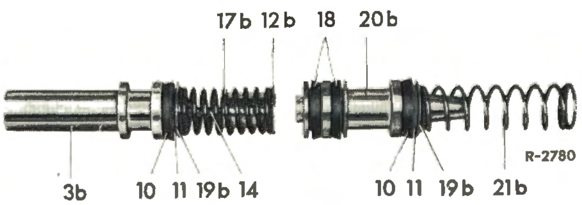


Fig. 42-3a/35

3b Piston
10 Primary cup
11 Thrust ring
12b Spring retainer
14 Connecting screw
18 Ring cup
19b Spring retainer
20b Intermediate piston
21b Pressure spring

Reassembly:

4. Screw the connecting screw (14) into the piston together with the pressure spring (17b) and the spring retainer (12b) (Fig. 42-3a/34).

5. Apart from the installation of the check valve or the special check valve further reassembly procedures are the same as in the case of the 1st version tandem master cylinder (see paras 10 to 19).

6. For the installation of the check valve and special check valve see para 14, 2nd version tandem master cylinder.

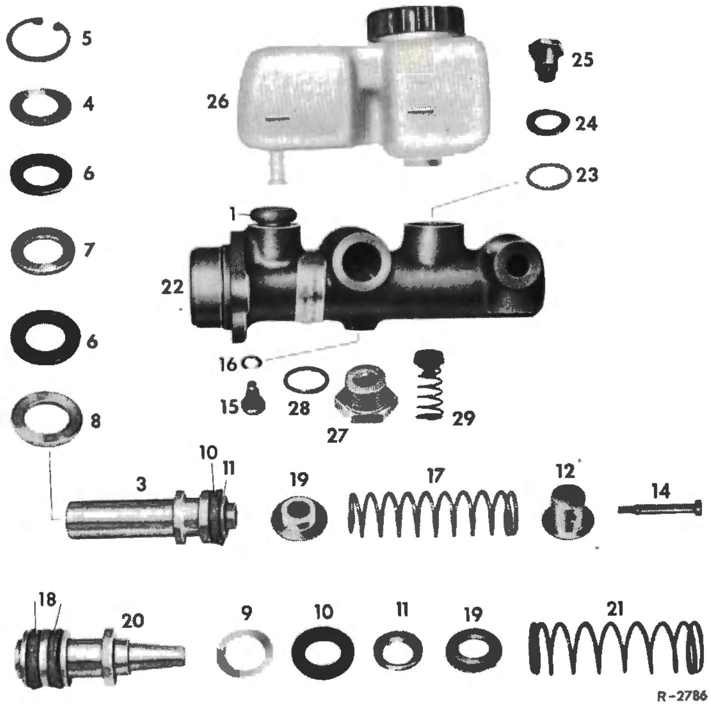


Fig. 42-3a/36

1 Plug
3 Piston (push rod circuit)
4 Piston stop washer
5 Piston stop ring
6 Vacuum sealing ring
7 Spacer ring
8 Support ring
9 Piston cup washer
10 Primary cup
11 Thrust ring
12 Spring retainer
14 Connecting screw
15 Stop screw for intermediate piston
16 Sealing ring (copper)
17 Pressure spring
18 Ring cup
19 Spring retainer
20 Intermediate piston (floating circuit)
21 Pressure spring
22 Housing
23 O-ring
24 Spring washer
25 Hollow screw
26 Reservoir
27 Connector
28 Sealing ring
29 Check valve or special check valve with spring

F. Check Valve and Special Check Valve

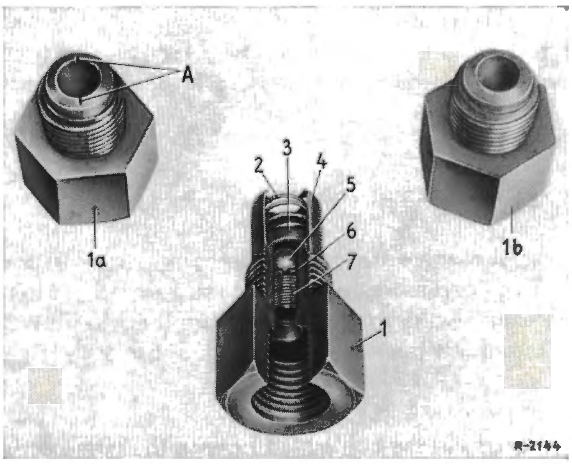


Fig. 42-3a/37

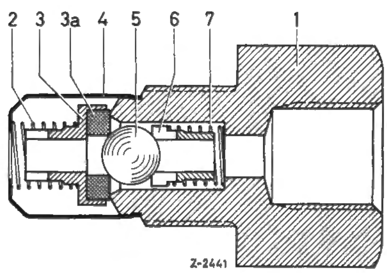


Fig. 42-3a/38

Check valve and special check valve in the 1st version tandem master cylinder

1 Connector with check valve
1a Connector for special check valve
1b Connector for check valve
2 Pressure spring
3 Spring retainer
4 Metal sleeve
5 Ball
6 Spring sleeve
7 Pressure spring
A Notches in the connector for the special check valve

1 Connector
2 Pressure spring
3 Spring retainer
3a Rubber ring
4 Metal sleeve
5 Ball
6 Spring sleeve
7 Pressure spring

Section X-Y

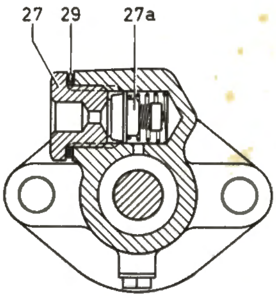


Fig. 42-3a/39

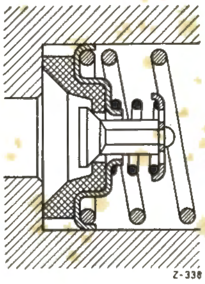


Fig. 42-3a/40

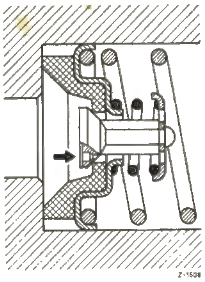


Fig. 42-3a/41

Check valve and special check valve in the 2nd version tandem master cylinder

27 Connector
27a Check valve or special check valve with spring
28 Sealing ring (copper)

Check valve

Special check valve in Model 300 SE

The check valve serves the purpose of keeping the brake fluid in the hydraulic system under a constant definite pressure, the so-called residual pressure (see Job No. 42-0). As a result the brakes respond quickly to even the slightest increase in pressure. In addition, the residual pressure prevents air from entering the hydraulic system.

Since the disk brakes must not have any residual pressure the brake lines for the disk brake are provided with a special check valve which permits the pressure to drop to zero when the brake pedal is released.

On the 1st **Version** tandem master cylinder the check valve operates as follows:

When the brake pedal is depressed the brake fluid forces the ball (5) together with the spring sleeve (6) toward the right against the pressure of the pressure spring (7) so that brake fluid can reach the individual consumer units. As soon as the brake pedal is released the returning brake fluid forces the ball together with the spring retainer (3) and the rubber ring (3a) toward the left and the brake fluid returns to the reservoir via the compensating port. However, the pressure spring (2) has been so dimensioned that the spring retainer together with the rubber ring is pushed onto the sealing seat of the connector as soon as the predetermined residual pressure is reached. This prevents a further decrease in the pressure (Fig. 42-3a/38). When the special check valve is installed the pressure in the brake lines falls to zero via the notches "A" (Fig. 42-3a/37).

On the 2nd **Version** tandem master cylinder the check valve operates as follows:

When the brake pedal is depressed the brake fluid pushes the valve toward the left and flows to the consumer units. When the brake pedal is released the valve assembly is pushed toward the right against the pressure exerted by the pressure spring. As soon as the pressure corresponding to that of the pressure spring is reached the valve closes and thus maintains the necessary residual pressure (Figs. 42-3a/39 to 42-3a/41).

When a special check valve is installed the brake fluid escapes via the calibrated bore in the valve cone until there is no longer any residual pressure in the brake-line system.

Primary Pressure Valve

Job No.
42-4

A. General

The primary pressure valve has been installed in vehicles which are equipped with disk brakes on the front axle. In order to ensure that the friction pads are released quickly and safely from the brake disk there must be no residual pressure in the line system leading toward the calipers and in the calipers themselves. Since, however, on the other hand a residual pressure of approx. 0.5–0.8 atm. is still required for the proper functioning of the drum brakes on the rear axle a primary pressure valve is required between the distributor fitting on the master cylinder and the brake lines to the rear axle.

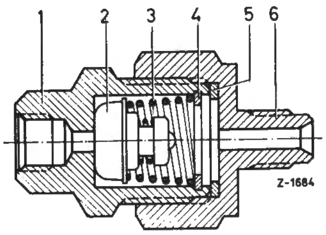


Fig. 42-4/1

1 Housing
2 Check valve
3 Pressure spring
4 Piston stop ring
5 Sealing ring
6 Threaded union

B. Removal and Installation of Primary Pressure Valve

Removal:

1. Detach the brake line (8) at the primary pressure valve (13) and unscrew the valve from the master cylinder (Fig. 42-4/2).

Installation:

2. Screw the primary pressure valve into the master cylinder.

3. Connect the brake line.

4. Bleed the brake system and check for leaks.

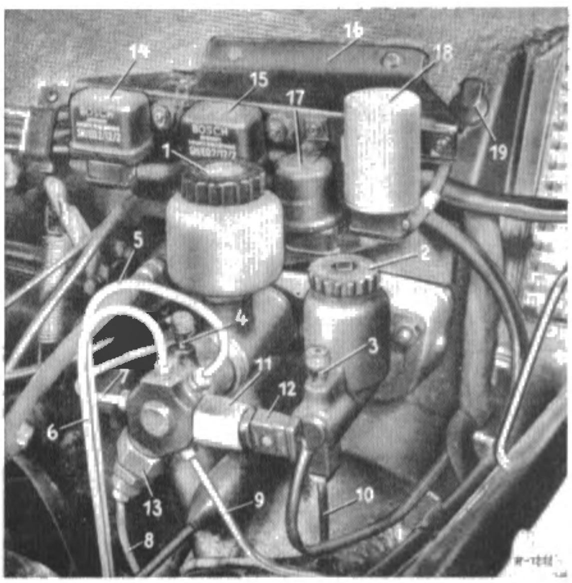


Fig. 42-4/2

Arrangement of master cylinder in cars with disk brakes on the front axle

1 Screw cap (master cylinder)
2 Screw cap (supply cylinder)
3 Bleed screw (master cylinder)
4 Bleed screw (supply cylinder)
5 Brake line
6 Brake line
7 Brake line
8 Brake line
9 Brake line
10 Line from supply cylinder to extraction cylinder
11 Stop light switch
12 Plug connection
13 Primary pressure valve
14 Relay
15 Relay
16 Assembly plate
17 Relay
18 Relay
19 Inspection lamp socket

Front Wheel Brake Cylinder

Job. No.
42-5

Modification: Attachment of 2nd version Wheel Cylinder and Section B added

A. Removal and Installation of Wheel Brake Cylinder

Removal:

1. Remove the brake shoes (see Job No. 42-8, Sections A and B).

2. Unscrew the hollow screws from the brake wheel cylinders and remove the brake line (4) from the brake wheel cylinders, paying attention to the rubber pad (5) between the line and the brake anchor plate (Fig. 42-5/1).

Note: When the brake hose has to be connected or disconnected at the brake line, the brake line should be held steady at the square socket (1) of the connectar.

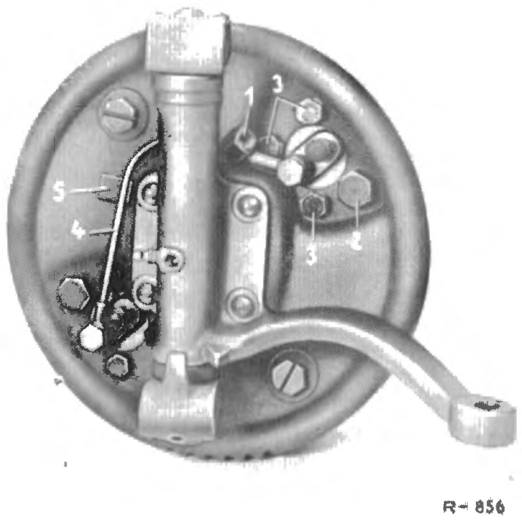


Fig. 42-5/1

1 Square socket at the brake line
2 Stop screw or hexagon screw
3 Hexagon screw
4 Brake line
5 Rubber pad

3. Unscrew the three hexagon screws (3) and remove the brake wheel cylinder (4) (Figs. 42-5/1 and 42-5/2).

Installation:

4. Place the brake wheel cylinder (4) in the brake anchor plate (1) and fasten with the three fixing screws (3). Fit new lock washers and make sure that the fixing screws are tightened evenly.

5. Attach the brake line (4) between the two brake wheel cylinders by means of the two hollow screws, using new copper gaskets. Then lay the rubber pad (5) between the brake line and the brake anchor plate.

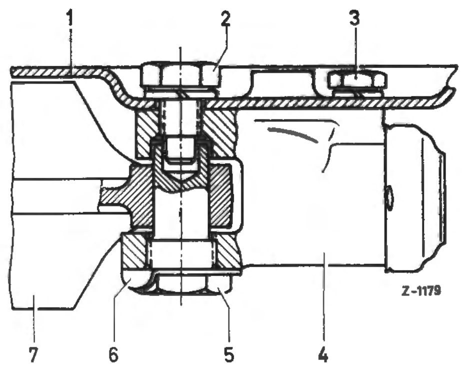


Fig. 42-5/2
1st version

1 Brake anchor plate
2 Stop screw
3 Hexagon screw
4 Brake wheel cylinder
5 Anchor pin
6 Locking plate
7 Brake shoe

Note: Care should be used in tightening the hollow screws in order to avoid distorting the brake line.

6. Screw in stop screw or hexagon screw (2) (Figs. 45-5/2 and 42-5/3).

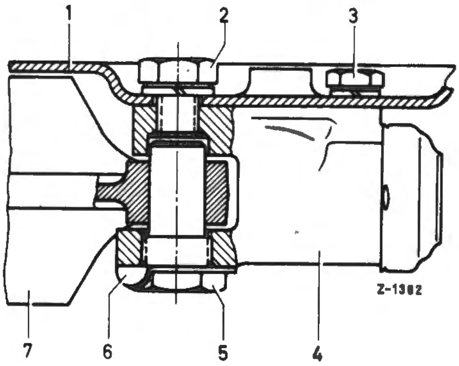


Fig. 42-5/3

2nd version

1 Brake anchor plate
2 Hexagon screw
3 Hexagon screw
4 Wheel cylinder
5 Anchor pin
6 Locking plate
7 Brake shoes

Note: In the 1st version of the brake shoe suspension the screw (2) is a stop screw which engages in the bore of the anchor pin and thus represents a limit stop. On the 2nd version the stop screw was replaced by a hexagon screw and in this case the stop is situated in the wheel cylinder eye.

7. Install the brake shoes (see Job No. 42-8, Sections A and B).

8. Bleed the brake system.

B. Disassembly, Checking, and Reassembly of Wheel Brake Cylinder

1. Unscrew the bleed screw from the brake wheel cylinder.

2. Remove the actuating pin (8), the metal boot (6), and the rubber boot (7). Then remove the piston (5), the cup (4), the cup expander (3), and the stop spring (2) from the brake wheel cylinder housing (Fig. 42-5/4).

3. Thoroughly clean all parts with brake fluid or alcohol.

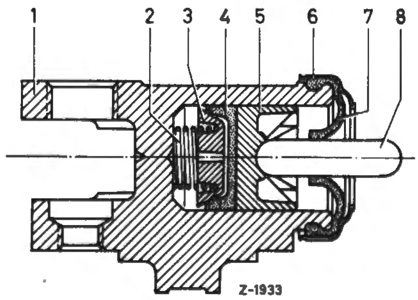


Fig. 42-5/4

1 Brake wheel cylinder housing
2 Spring
3 Pistòn cup expander
4 Cup
5 Piston
6 Metal boot
7 Rubber boot
8 Actuating pin

Checking:

4. Check the brake wheel cylinder bore for wear, scoring, and rust. Scored or rusty brake wheel cylinders must be replaced (for measurements see Job No. 42-0).

5. Check the piston for scoring and wear.

Reassembly:

6. The bore in the brake wheel cylinder, the piston, and a new cup should be lightly coated with brake fluid or ATE blue brake paste.

Note: When reassembling the brake wheel cylinder, always use new cups and new rubber bóots.

7. Slide the stop spring (2), the cup expander (3), a new cup (4), and the piston (5) into the bore of the brake wheel cylinder (Fig. 42-5/4).

8. Press on the rubber boot (7) and the metal boot (6); then install the actuating pin (8) (see Fig. 42-5/4).

Job No.
42-6

Rear Wheel Brake Cylinder

Modification: Note before para 9 in Section B modified

A. Removal and Installation of Wheel Brake Cylinder

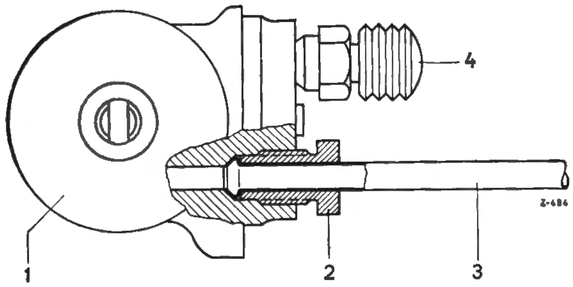


Fig. 42-6/1

1 Wheel brake cylinder
2 Cap screw
3 Brake line
4 Rubber cap of bleed screw

Removal:

1. Use a sturdy screw driver to force the brake shoes with automatic adjustment outward as far as they will go. Move the brake shoes with mechanical adjustment forward as far as they will go by turning the adjustment bolt.

2. Unscrew the cap screw (2) which fastens the brake line (3) to the brake wheel cylinder (1) (Fig. 42-6/1).

3. Screw out the hexagon screws from the brake wheel cylinder and pull out the brake wheel cylinder from the brake anchor plate.

Installation:

Note: For some time cars with two-circuit brakes were equipped with new wheel cylinders Part No. 002 429 09 18. These wheel cylinders are provided with cups with 7 blind holes.

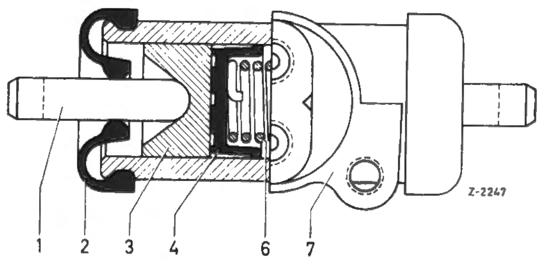


Fig. 42-6/2

1 Pressure bolt
2 Rubber cap
3 Piston
4 Blind hole cup
6 Pressure spring
7 Wheel brake cylinder

4. Fasten the brake wheel cylinder to the brake anchor plate. Use new lock washers. Make sure that the fixing screws are tightened evenly.

5. Screw the brake line to the brake wheel cylinder.

Note: Make sure that the brake line is properly laid along the rear axle tubes. The rubber rings on the brake line are a protection against rubbing wear and should rest against the axle tube.
On recent cars the brake lines are attached to the rear axle tubes by means of hose straps.

6. Force the brake shoes with automatic adjustment inward with a sturdy screw driver. Move the brake shoes with mechanical adjustment inward by turning the adjustment bolt, making sure that the retaining pins are properly seated in the brake shoes.

7. In the case of mechanically adjusted brake shoes adjust the brakes (see Job No 42-20, Section A).

8. On models with automatic brake adjustment depress the brake pedal several times before starting the car, so that the brake shoes can adjust themselves and make contact with the brake drums.

Note: Never omit this procedure; there can be no brake action until the brake shoes have adjusted themselves.

9. Bleed the brake system.

B. Disassembly, Checking, and Reassembly of Brake Wheel Cylinder

Disassembly:

1. Unscrew the bleed screw from the brake wheel cylinder.
2. Remove the actuating pins (1) and the two rubber boots (2) (Fig. 42-6/4).

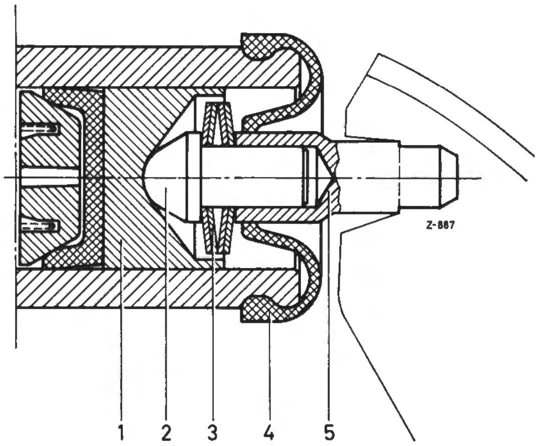


Fig. 42-6/3

Cylinder with spring-loaded actuating pin

1 Piston
2 Bolt
3 Cup spring
4 Rubber boot
5 Guide pin

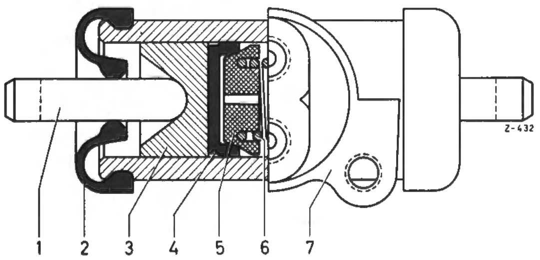


Fig. 42-6/4

Cylinder with rigid actuating pin

1 Actuating pin
2 Rubber boot
3 Piston
4 Cup
5 Piston cup expander
6 Spring
7 Wheel cylinder

3. Remove the two pistons (3), the two cups (4), the two cup expanders (5), and the spring (6) from the brake wheel cylinder bore (Fig. 42-6/4).
4. Thoroughly clean all parts with brake fluid or alcohol.

Checking:

5. Check the brake wheel cylinder bore for wear, scoring, and rust. Scored or rusty brake wheel cylinders must be replaced (for measurements see Job No. 42-0).
6. Check the two pistons for scoring and wear.
7. Check the spring-loaded actuating pins for ease of movement; the guide pin (5) must move easily in the bolt (2). Coat the sliding surfaces with Molycote paste type "G" before reassembly. If new cup springs (3) are installed, make sure that they have a diameter of 15 mm. These cup springs should be installed in such a way that the two pairs are opposed to one another (Fig. 42-6/3).

Reassembly:

8. The bore in the brake wheel cylinder, the two pistons, and the two new cups should be lightly coated with brake fluid or ATE blue brake paste.

Note: When reassembling the brake wheel cylinder, always use new cups and new rubber boots.

For some time cars with two-circuit brake systems were equipped with ¾" wheel brake cylinders with blind hole cups (see Fig. 42-6/2). When repairs are carried out these blind hole cups should be replaced by the previous version cups which are contained in the Repair Set 000 586 12 42.

9. Insert a new cup (4) and piston (3) in the bore of the brake wheel cylinder. Press on a rubber boot (2) at this side (Fig. 42-6/4).
10. Now install a cup expander (5) and the spring (6) from the other side into the brake wheel cylinder in such a way that the cup expander rests snugly against the cup (Fig. 42-6/4).

Note: The spring must be properly seated in the cup expander.

11. Install the second cup expander (5), the second cup (4), and the second piston (3). Then press the second rubber boot onto the brake wheel cylinder (Fig. 42-6/4).
12. Insert the actuating pin.

Removal and Installation of Brake Caliper

Job. No.
42-7

*Modification: Various modifications (marked *) added in Section A.*
Teves Disk Brake new in Section B.

A. Front Brake Caliper

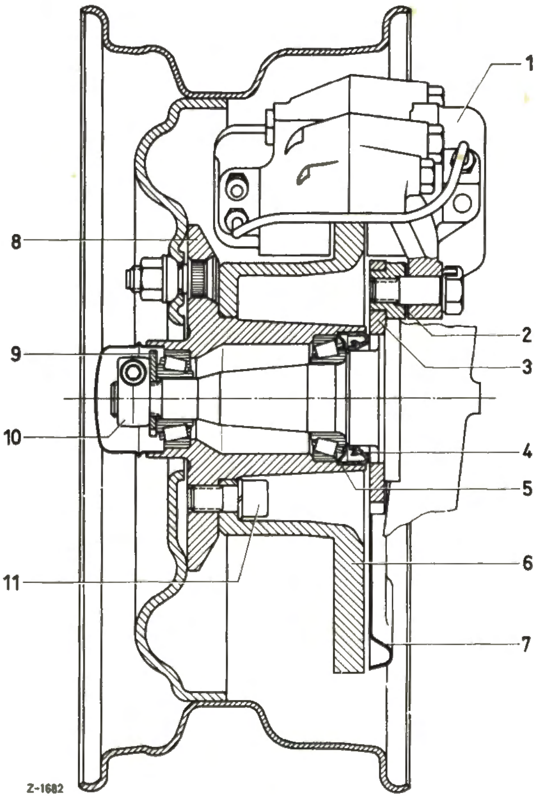


Fig. 42-7/1

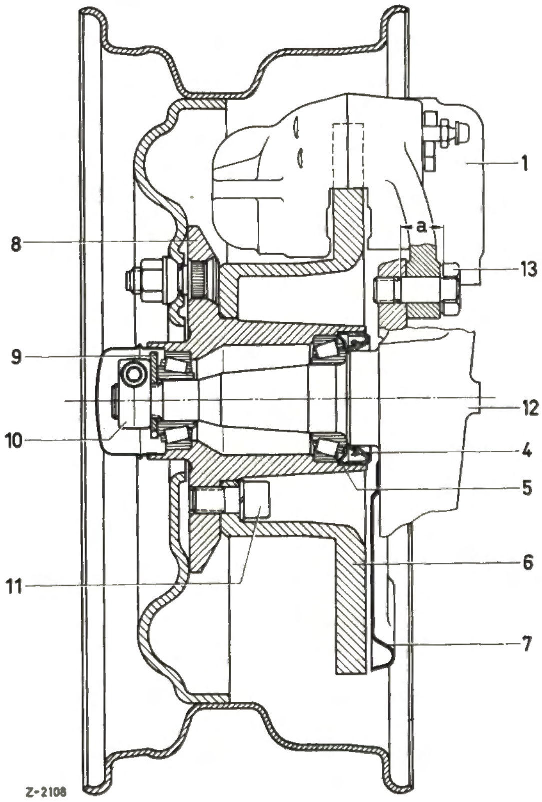


Fig. 42-7/2

Disk brake Make Girling

3rd version — 1st and 2nd versions

1 Brake caliper
2 Shim
3 Steering knuckle bracket
4 Rubber seal
5 Disk
6 Brake disk
7 Cover plate
8 Front wheel hub
9 Washer
10 Clamping nut
11 Hexagon socket screw
12 Steering knuckle
13 Hexagon fitting screw
a = Shank length of hexagon fitting screw

Removal:

Note: In the case of Dunlop the brake caliper, as a rule, need only be removed if the brake disk or the front wheel hub has to be removed. In the case of pressure cylinder leaks it is quite sufficient to remove the cylinder from the brake caliper and to replace either the piston seal or the pressure cylinder.

1. Detach the brake line (11) from the brake caliper (9) (Figs. 42-7/5, 42-7/6, and 42-7/7).

Note: Various brake caliper makes have been
* installed which in the course of time have been modified; the brake lines are connected as follows:

Note: On the 1st version of the Girling brake caliper the brake line is attached to the inner pressure cylinder by a hollow screw. The connector for the brake hose points upward. The bleed screw is arranged in the outer brake caliper half (Fig. 42-7/5).

In the case of the **2nd version** the brake line is attached to the outer pressure cylinder. The connector for the brake hose is attached behind the steering knuckle and the bleed screw is on the inner pressure cylinder (Fig. 42-7/6).

In addition, heat screening plates have been arranged between the pistons and friction pads to protect the dust caps.

* In the case of the 3rd **version** of the Girling brake caliper the brake line is connected to the inner pressure cylinder and the connecting line has been dispensed with (Fig. 42-7/7).

* On the **Teves brake caliper** the connection is the same as on the 3rd version Girling brake caliper.

On the **Dunlop disk brake** the line is attached to the outer pressure cylinder (Fig. 42-7/8).

2. Tap up the locking plate (14). Unscrew the hexagon fitting screws (13) and remove the brake caliper (Fig. 42-7/5 to 42-7/8). Pay attention to the shims arranged between the bracket and the fixing eyes of the brake caliper (Figs. 42-7/1, 42-7/2, and 42-7/3).

Note: The brake caliper must have cooled down to normal temperature before the hexagon fitting screws are loosened.

* In the case of 1st version steering knuckles where the brake caliper bracket is riveted to the steering knuckles, shims have been installed between the fixing eyes of the caliper and the bracket. Pay attention to the shims when removing the brake caliper.

Installation:

3. Attach the brake caliper to the bracket making sure that a new locking plate is used and in the case of a 1st version steering knuckle that the shims are reinstalled between bracket and fixing eyes of the brake caliper in the same way as before (Figs. 42-7/2 and 7/3).

* Because of the larger brake disk diameter on Models 250 S, 250 SE, 300 SEb and 300 SEL only brake calipers marked '14' on the internal pressure cylinder should be installed. These brake calipers have a machined brake disk passage.

Note: When installing the brake caliper make sure that the bleed screw is on top.

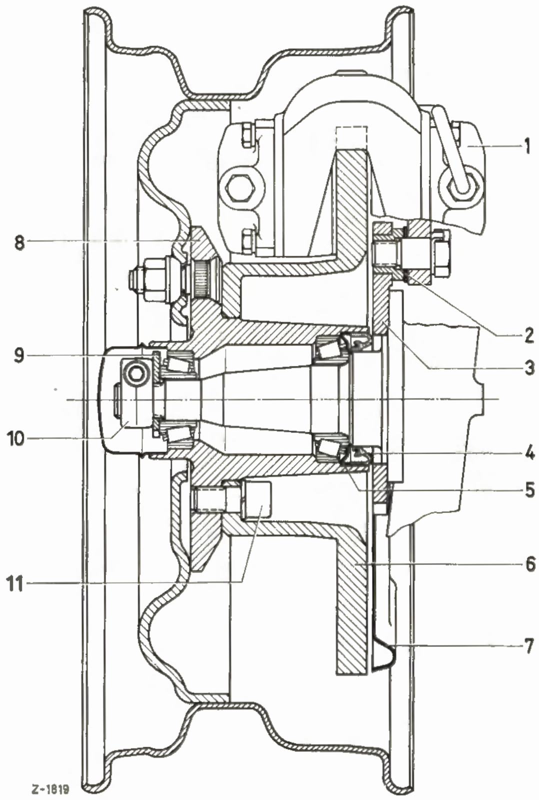


Fig. 42-7/3

Dunlop Disk Brake

1 Brake caliper
2 Shim
3 Steering knuckle bracket
4 Rubber seal
5 Disk
6 Brake disk
7 Cover plate
8 Front wheel hub
9 Washer
10 Clamping nut
11 Hexagon socket screw

On 3rd version Girling brake calipers the shank of the hexagon fitting screw (13) has a length of a = 20 mm. The hexagon fitting screw with a shank length of a = 21 mm used on the 1st and 2nd version Girling brake calipers must on no account be used on the 3rd version caliper (Fig. 42-7/2).

* The locking plates have been modified several times. Use locking plate Part No. 111 994 04 32 for Teves and Girling brake calipers and locking plate Part. No. 112 994 03 32 for Dunlop brake calipers. The sheet-metal extension of this locking plate should be bent over the rubber ring (19) of the brake line in order to secure the line in position (Fig. 42-7/8).

Also for the Dunlop brake caliper has the locking plate been changed. The extended locking plate has to be bent over the rubber ring (19) of the brake line in order to ensure that the brake line has been properly laid. The locking plate has the Part. No. 112 994 03 32 (Fig. 42-7/8).

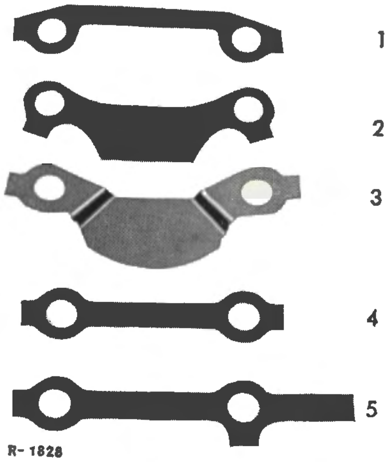


Fig. 42-7/4

1 Locking plate Part No. 111 994 01 32 for Girling brake caliper 1st and 2nd version
2 Locking plate Part No. 111 994 01 32 for Girling brake caliper 3rd version
3 Locking plate 2nd version Part No. 111 994 04 32 for Girling brake caliper 3rd version and Teves brake caliper
4 Locking plate 1st version Part No. 112 994 01 32 for Dunlop brake caliper
5 Locking plate 2nd version Part No. 112 994 03 32 for Dunlop brake caliper

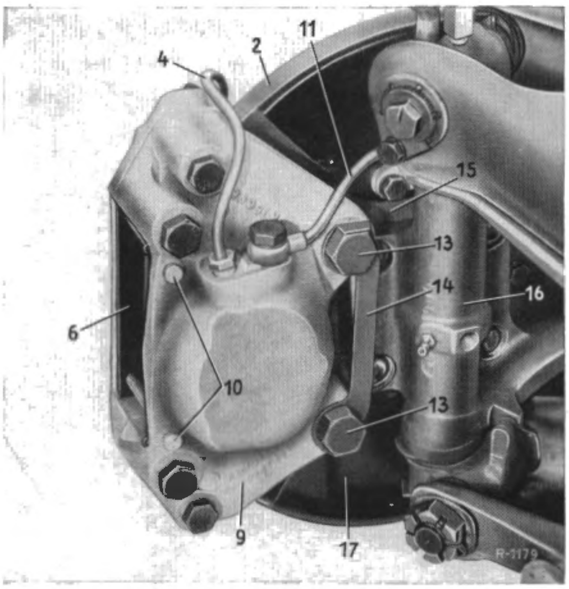


Fig. 42-7/5

Arrangement of Girling disk brake 1st version

2 Brake disk	13 Hexagon fitting screw
4 Connecting line	14 Locking plate
6 Friction pad	15 Steering knuckle bracket
9 Brake caliper	16 Steering knuckle
10 Locking pin	17 Cover plate
11 Brake line with connector	

4. Use a feeler gage to check the position of the brake caliper in relation to the brake disk at the machined points "M" of the brake calipers as follows (Figs. 42-7/11 and 42-7/12).

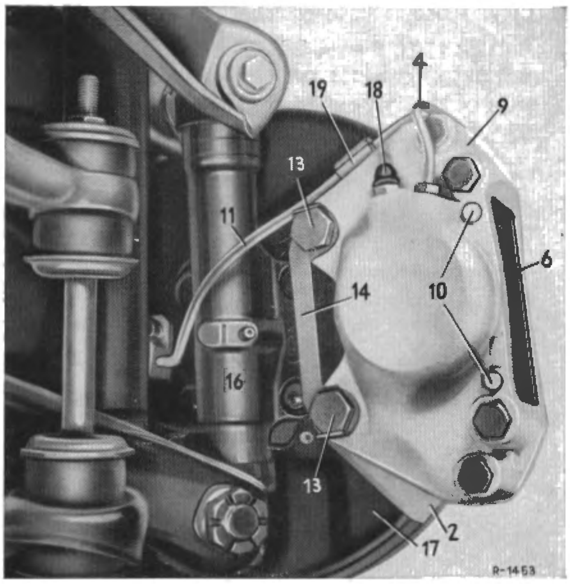


Fig. 42-7/6

Arrangement of Girling disk brake 2nd version

2 Brake disk	13 Hexagon fitting screw
4 Connecting line	14 Locking plate
6 Friction pad	16 Steering knuckle
9 Brake caliper	17 Cover plate
10 Locking pin	18 Bleed screw
11 Brake line with connector	19 Rubber lug

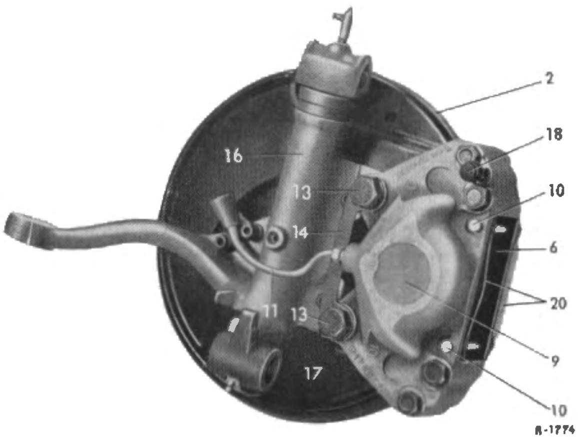


Fig. 42-7/2

Arrangement of Girling disk brake 3rd version

2 Brake disk	14 Locking plate
6 Friction pad	16 Steering knuckle
9 Brake caliper	17 Cover plate
10 Locking pin	18 Bleed screw with rubber cap
11 Brake line with connector	20 Heat screening plate
13 Hexagon fitting screw	

a) The brake caliper must be installed parallel to the brake disk. The distance between caliper and brake disk (aperture a) measured on the inner side of the brake disk must not differ between top and bottom measurements by more than the amount given in Job No. 42-0 (Figs. 42-7/11 to 42-7/14).

b) The brake caliper must be installed in such a way that the aperture (a) is as nearly the same as possible on the inside and the outside of the caliper (see Job. No. 42-0 and Figs. 42-2/11 to 42-2/14).

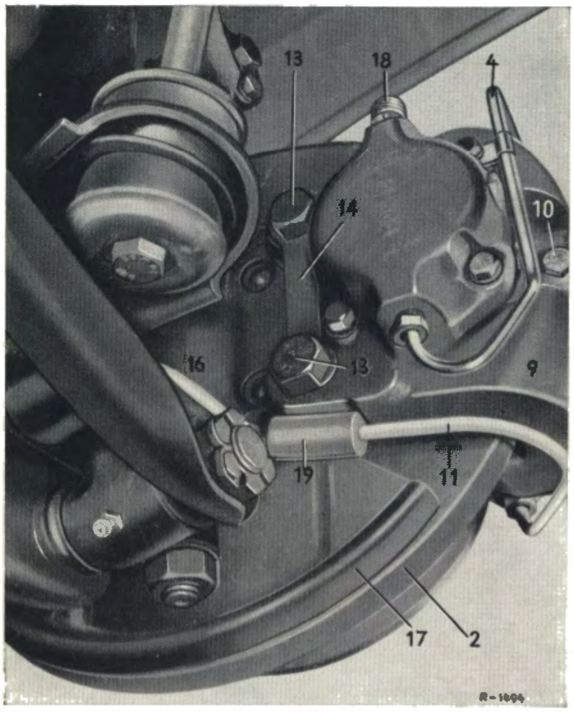


Fig. 42-7/8

Arrangement of Dunlop disk brake

2 Brake disk
4 Connecting line with hose clip
9 Brake caliper
10 Hexagon screw
11 Brake line with connector
13 Hexagon fitting screw
14 Locking plate
16 Steering knuckle
17 Cover plate
18 Bleed screw
19 Rubber ring

c) Shims are available in various thicknesses in order to facilitate proper positioning of the brake caliper in the case of 1st version steering knuckles (riveted bracket) (see Job No. 42-0).

d) If on 2nd version steering knuckles (steering knuckle and bracket forged integral) the deviations exceed the amount stated under a) and b) above, first check the steering knuckle for distortion on the fixing eyes.

Then check the caliper by measuring the distance from the aperture of the caliper to the fixing eyes. If the difference exceeds 0.2 mm the caliper must be replaced.

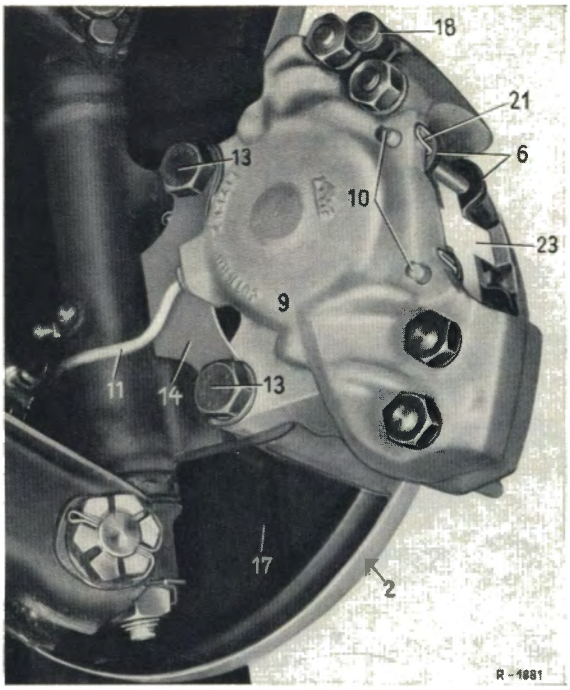


Fig. 42-7/9

Arrangement of Teves disk brake

2 Brake disk
6 Friction pad
9 Brake caliper
10 Retaining pin
11 Brake line with connector
13 Hexagon fitting screw
14 Locking plate
17 Cover plate
18 Bleed screw with rubber cap
21 Locking clip
23 Cross leaf spring

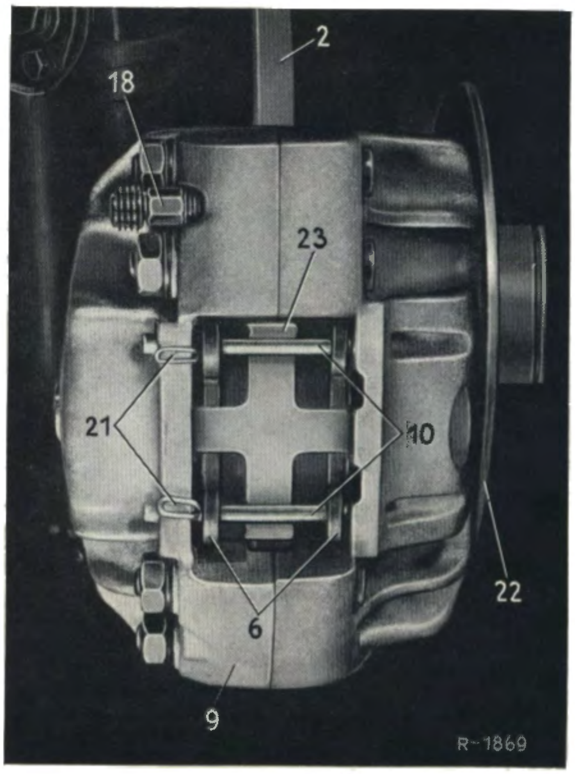


Fig. 42-7/10

Arrangement of Teves disk brake

2 Brake disk
6 Friction pad
9 Brake caliper
10 Retaining pin
18 Bleed screw with rubber cap
21 Locking clip
22 Front wheel hub
23 Cross leaf spring

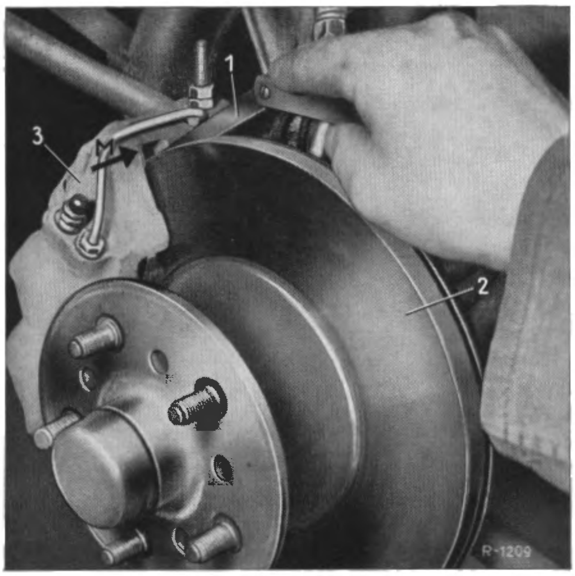


Fig. 42-7/11

Girling brake caliper

1 Feeler gage 3 Brake caliper
2 Brake disk M = Measuring point

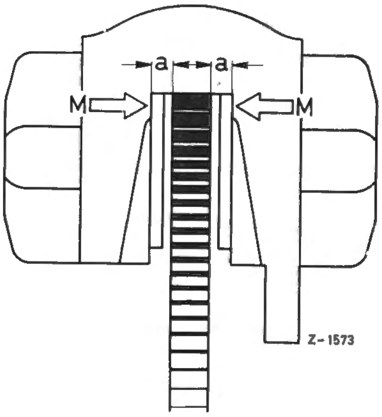


Fig. 42-7/14

M = Measuring point

5. Tighten the hexagon fitting screws with the prescribed torque (see Job. No. 42-0) and secure by means of the locking plate.

6. Connect the brake line (11) (see Figs. 42-7/5 to 42-7/6, and 42-7/7).

Note: a) When connecting the brake line to the 1st version Girling brake caliper install new copper sealing rings (see Fig. 42-7/5).

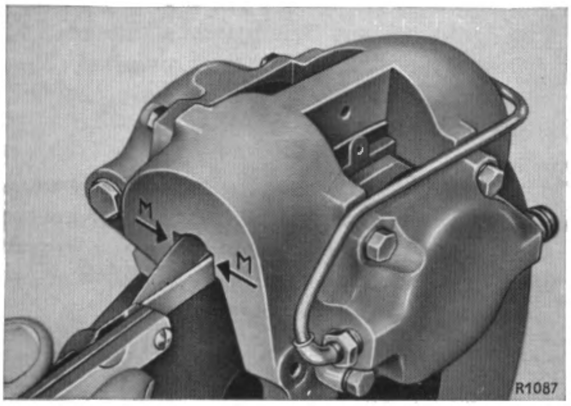


Fig. 42-7/12

Dunlop brake caliper

M = Measuring point

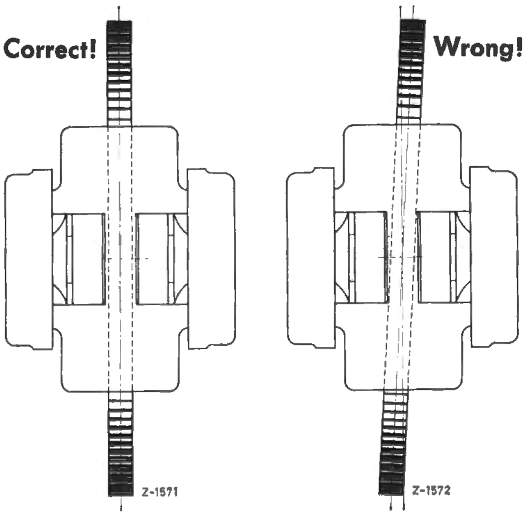


Fig. 42-7/13

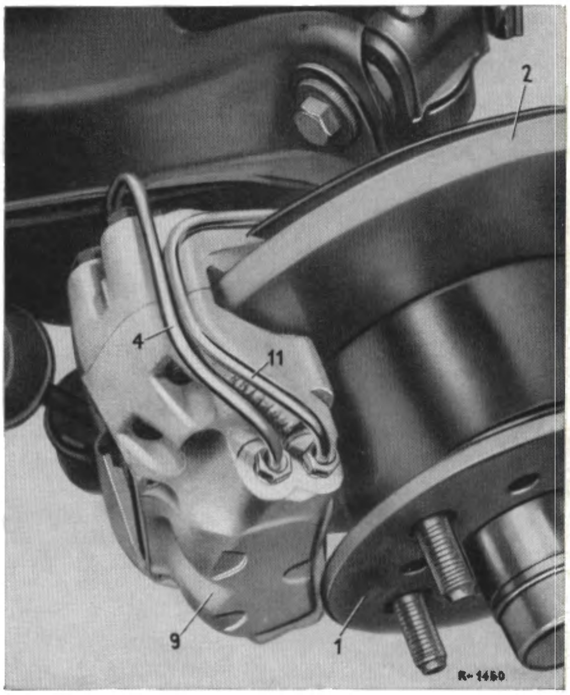


Fig. 42-7/15

Arrangement of Girling brake caliper 2nd version

1 Front wheel hub 9 Brake caliper
2 Brake disk 11 Brake line
4 Connecting line

b) Make sure that on the 1st and 2nd version Girling brake caliper the connecting line (4) is properly laid. If a 1st or 2nd version Girling brake caliper is replaced by a 3rd version caliper, the brake line (11) must also be replaced since on the 3rd version caliper the brake line is connected to the inner pressure cylinder (Fig. 42-7/15).

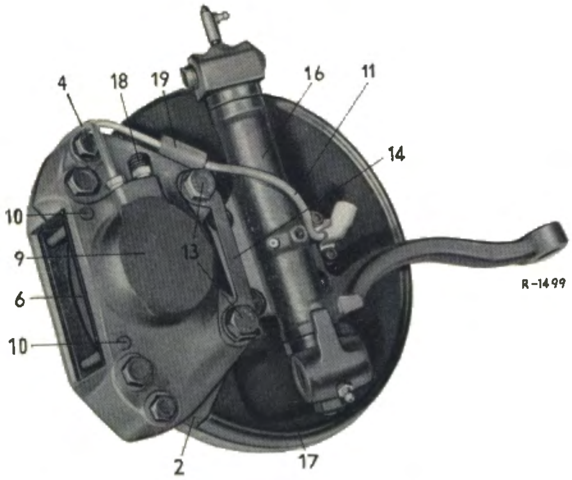


Fig. 42-7/16

Arrangement of Girling brake caliper 2nd version

2 Brake disk	13 Hexagon fitting screw
4 Connecting line	14 Locking plate
6 Friction pad	16 Steering knuckle
9 Brake caliper	17 Cover plate
10 Locking pin	18 Bleed screw
11 Brake line with connector	19 Rubber ring

7. Bleed the brake system and check for leaks.

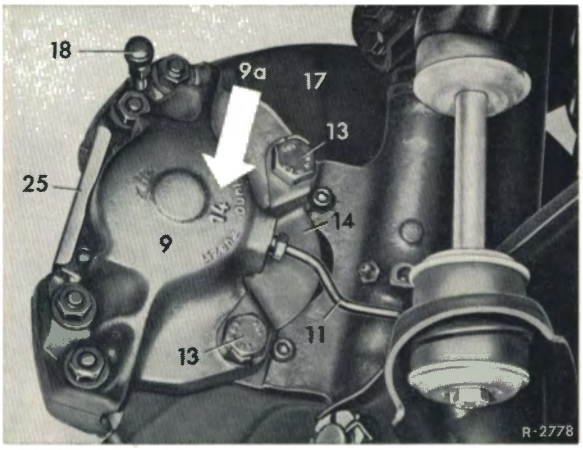


Fig. 42-7/17

9 Brake caliper	14 Locking plate
9a Code number	17 Cover plate
11 Brake line	18 Bleed screw with rubber cap
13 Hexagon fitting screw	25 Cover plate

8. Before starting the car, depress the brake pedal hard several times to make sure that on Girling and Teves disk brakes the friction pads

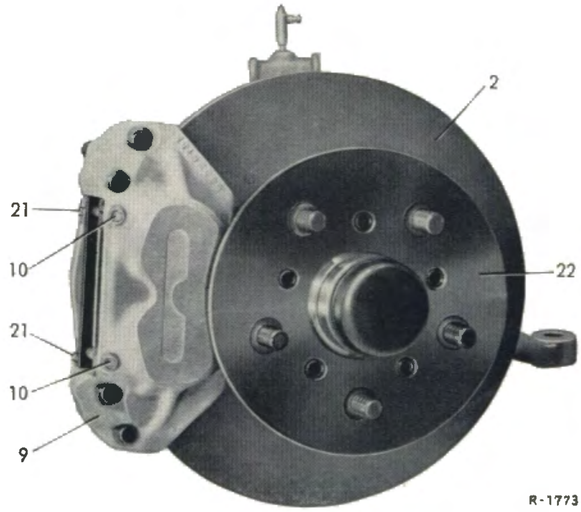


Fig. 42-7/18

Arrangement of Girling brake caliper 3rd version

2 Brake disk	21 Lock
9 Brake caliper	22 Front wheel hub
10 Retaining pin	

make contact with the brake disk and on Dunlop brake calipers the clearance between friction pads and brake disks is adjusted. Then check and if necessary top up the brake fluid reserve in the reservoir.

Note: Do not fail to depress the brake pedal several times before driving the car away because the brakes will not operate unless the friction pads make contact with the brake disk or the correct clearance is obtained.

9. Turn the steering mechanism to full left and right lock several times in order to make sure that the brake hoses do not rub against any part.

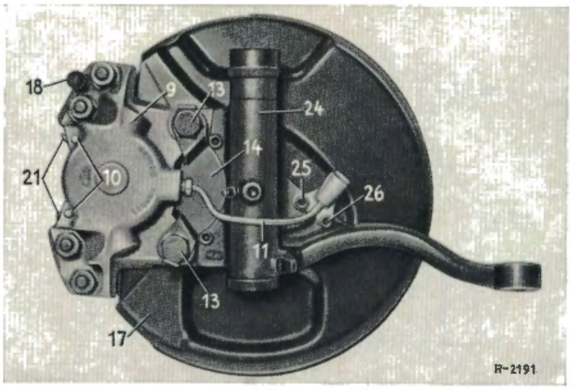


Fig. 42-7/19

9 Brake caliper	18 Bleed screw with rubber cap
10 Locking pin	21 Locking clip
11 Brake line	24 Steering knuckle
13 Hexagon fitting screw	25 Hexagon socket screw
14 Locking plate	26 Hexagon socket screw
17 Cover plate	

B. Rear Brake Caliper

a) Make Dunlop and Teves on Model 300 SE

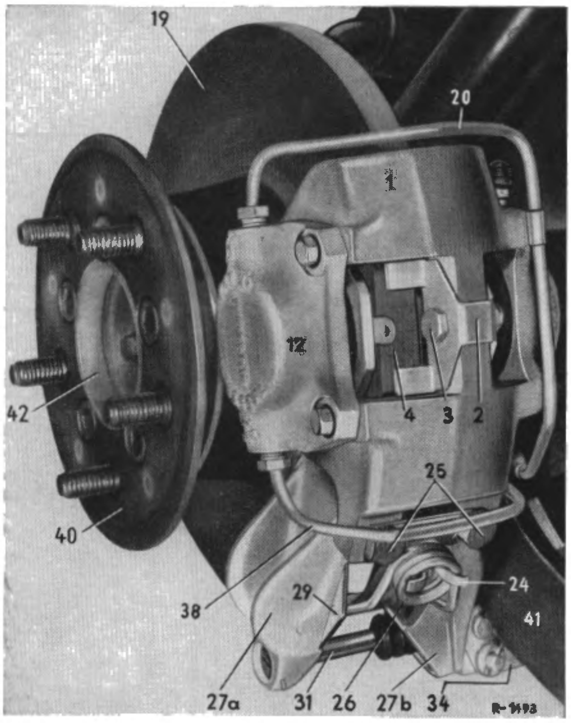


Fig. 42-7/20

Arrangement of Dunlop brake caliper

1 Brake caliper
2 Stirrup
3 Hexagon screw with hexagon nut and serrated washer
4 Friction pad with mounting plate (service brake)
12 Pressure cylinder
19 Brake disk
20 Connecting line with pipe clip
24 Locking plate
25 Swing bolt
26 Leg spring
27a Outer lining carrier
27b Inner lining carrier
29 Friction pad with mounting plate (hand brake)
31 Adjustment screw
34 Tension lever
38 Brake line
40 Wheel fixing disk
41 Brake support lever
42 Rear axle shaft

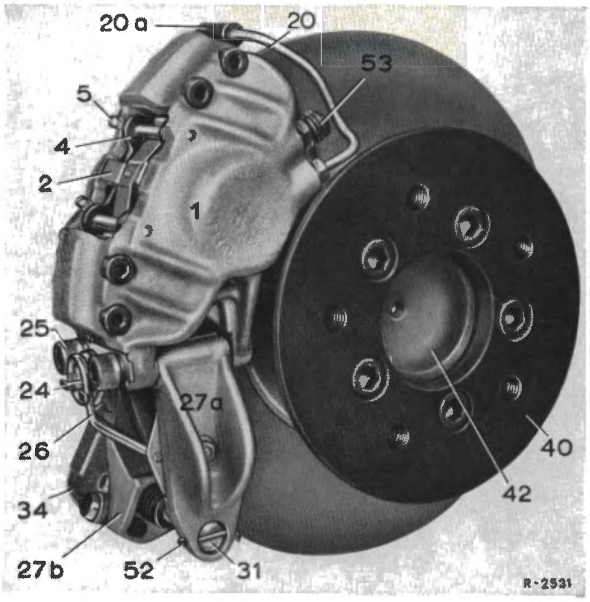


Fig. 42-7/21

Arrangement of Teves Brake Caliper

1 Brake caliper
2 Cross leaf spring
4 Friction pad (service brake)
5 Locking clip
20 Connecting line
20a Rubber ring
24 Retaining plate for leg spring
25 Swing bolt
26 Leg spring
27a Outer lining carrier
27b Inner lining carrier.
31 Adjustment screw
34 Tension lever
40 Wheel fixing disk
42 Rear axle shaft
52 Cotter pin

Removal:

Note: As a rule, the Dunlop brake caliper need only be removed if the brake disk, the bearing housing of the brake support or the rear axle shaft has to be removed. In the case of pressure cylinder leaks it is quite sufficient to remove the cylinder from the brake caliper and to replace either the piston seal or the pressure cylinder.

1. Disconnect the brake line (38) from the outer pressure cylinder (12) (Fig. 42-7/20).

2. Remove the hand brake caliper (see Job No. 42-25).

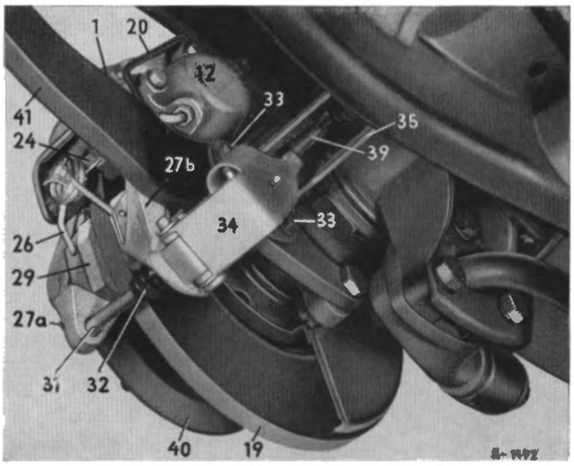


Fig. 42-7/22

Arrangement of Dunlop brake caliper

1 Brake caliper
12 Pressure cylinder
19 Brake disk
20 Connecting line
24 Locking plate
26 Leg spring
27a Outer lining carrier
27b Inner lining carrier
29 Friction pad (hand brake)
31 Adjustment screw
32 Rubber sleeve
33 Hexagon screw with washer
34 Tension lever
35 Rear brake cable bracket
39 Rear brake cable
40 Wheel fixing disk
41 Brake support lever

3. Tap up the locking plates (47), unscrew the hexagon fitting screws (46), and remove the brackets (48) with the welded-on nuts (Figs. 42-7/23 and 42-7/24).

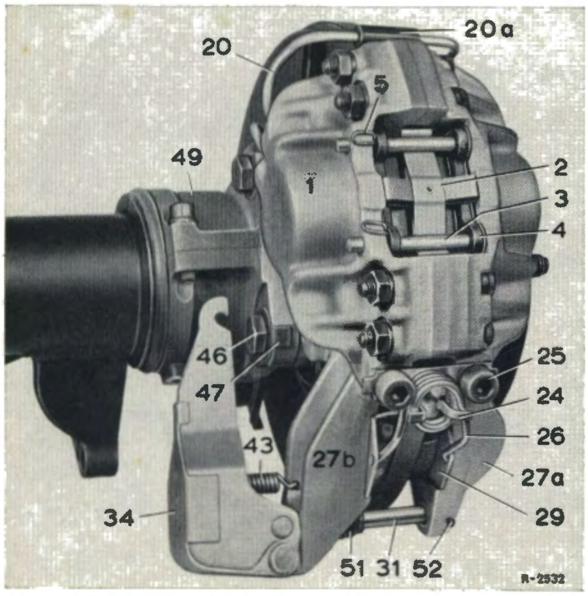


Fig. 42-7/23

Arrangement of Teves Brake Caliper

1	Brake caliper	27a	Outer lining carrier
2	Cross leaf spring	27b	Inner lining carrier
3	Locking pin	29	Friction pad (hand brake)
4	Friction pad (service brake)	31	Adjustment screw
5	Locking clip	34	Tension lever
20	Connecting line	43	Return spring
20a	Rubber ring	46	Hexagon fitting bolt
24	Retaining plate for leg spring	47	Locking plate
25	Swing bolt	49	Bearing housing
26	Leg spring	51	Rubber sleeve
		52	Cotter pin

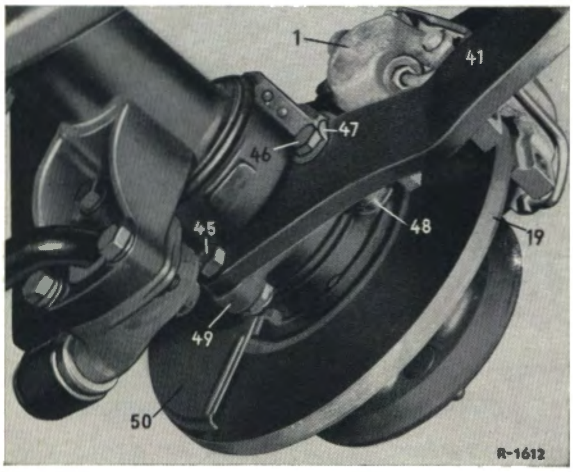


Fig. 42-7/24

1	Brake caliper	47	Locking plate
19	Brake disk	48	Bracket
41	Brake support lever	49	Bearing housing
45	Hexagon screw	50	Cover plate
46	Hexagon fitting screw		

4. Remove the brake caliper (1) paying attention to the shims (2) arranged between the bearing housing (41) and the caliper (Fig. 42-7/25).

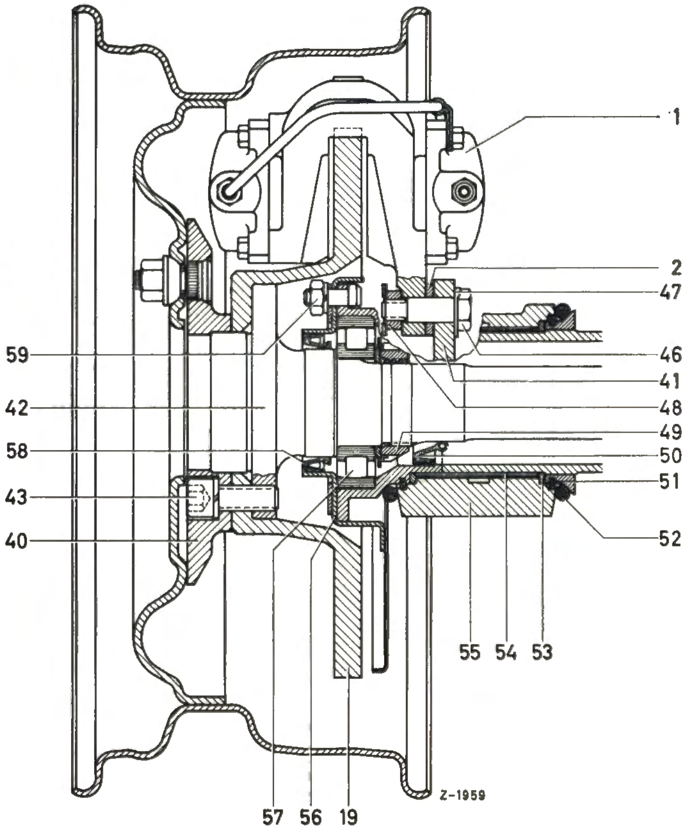


Fig. 42-7/25

1	Brake caliper	50	Seal
2	Shim	51	Sealing ring
19	Brake disk	52	Rubber ring
40	Wheel fixing disk	53	Split shim
41	Fixing eye on the bearing housing	54	Bearing shell
42	Rear axle shaft	55	Bearing housing
43	Hexagon socket screw	56	Sealing ring retainer
46	Hexagon fitting bolt	57	Barrel roller bearing
47	Locking plate	58	Seal
48	Bracket	59	Fitting bolt with hexagon nut and lock washer
49	Grooved nut with lock		

Installation:

5. Fit the brake caliper (1) to the bearing housing (41) and install the shims (2) between bearing housing and the fixing eyes of the caliper in the same way as before (Fig. 42-7/25).

6. Put new locking plates (47) on the hexagon fitting screws (46) and start by screwing in the top fitting screw. At the same time press in the bracket (48) with the welded-on nuts against the fitting screw (Figs. 42-7/23 and 42-7/24).

Note: On cars equipped with Teves Brake calipers, a modified cover plate (5) (Fig. 42-7/24) has been installed. In this version the bracket with weld-on nuts is no longer required since the hexagon fitting bolts are screwed into the weld-on nuts of the cover plate.

7. Screw in the lower fitting screw.

8. Tighten the two hexagon fitting screws with the prescribed torque (see Job No. 42-0).

9. Measure the position of the brake caliper in relation to the brake disk (see Section A).

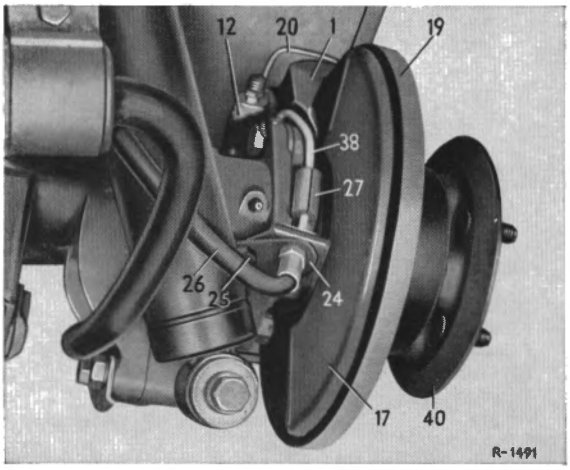


Fig. 42-7/26

1 Brake caliper
12 Pressure cylinder
17 Cover plate
19 Brake disk
20 Connecting line
24 Locking plate
25 Hexagon screw
26 Brake hose
27 Rubber ring
38 Brake line
40 Wheel fixing disk

Note: a) Since the fulcrum of the right rear axle shaft and the rear axle tube are on different levels, the brake disk which is fastened to the rear axle shaft is not always parallel to the bearing housing carying the brake caliper when the car settles on its suspension. Before aligning the right brake caliper it is necessary therefore to lift the right axle tube until it is on the same horizontal plane as the left axle tube which is attached to the rear axle housing.

b) The shims are available in various thicknesses (see Job No. 42-0).

10. Secure the hexagon fitting screws by means of the locking plates.

11. Install the hand brake caliper (see Job No. 42-25).

12. Connect the brake line (38) making sure that the rubber ring (27) is properly positioned (Fig. 42-7/26).

Note: The minimum distance of the brake line (38) from the cover plate (17) is 10 mm.

13. Bleed the brake system and check for leaks.

14. Before starting the car, vigorously depress the brake pedal several times so that the clearance between friction pads and brake disk can adjust itself. Then check the amount of brake fluid in the reservoir of the main cylinder and if necessary top up.

Note: Do not fail to depress the brake pedal several times before driving the car away because the brakes will not operate unless the correct clearance is obtained.

b) Make Teves on Models 250 S, 250 SE, 300 SEb and 300 SEL

Removal:

1. Jack up the car and remove the wheels. On cars with air suspension pay attention to the lifting and jacking up instructions.

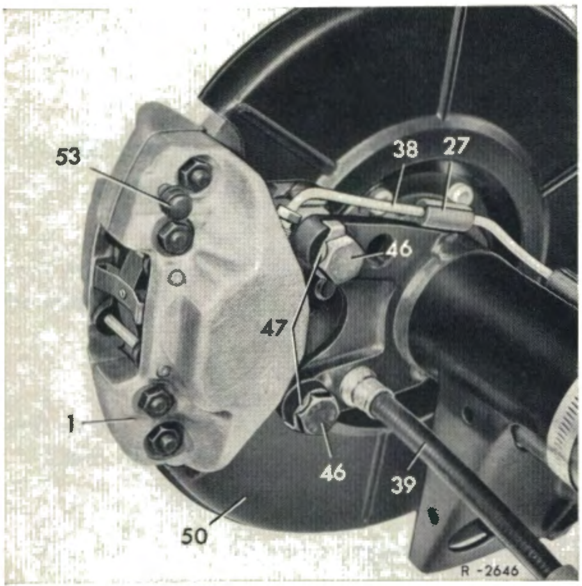


Fig. 42-7/27

Arrangement on Models 250 S, 250 SE, and 300 SEb

1 Brake caliper	46 Hexagon fitting screw
27 Rubber ring	47 Locking plate
38 Brake line	50 Cover plate
39 Brake cable	53 Bleed screw with rubber cap

2. Detach the brake line (38) from the brake caliper (1). Close the brake line and the connection in the brake caliper with dummy plugs.

Installation:

3. Fit the bracket (48) to the brake caliper fixing eyes and fit the brake caliper to the bracket on the rear axle. Screw the hexagon fitting screws (46) into the bracket using new locking plates (47), tighten the screws with the prescribed torque and lock them (see Job No. 42-0).

4. Attach the brake line to the brake caliper. Bleed the brakes and check for leaks (see Job No. 42-23).

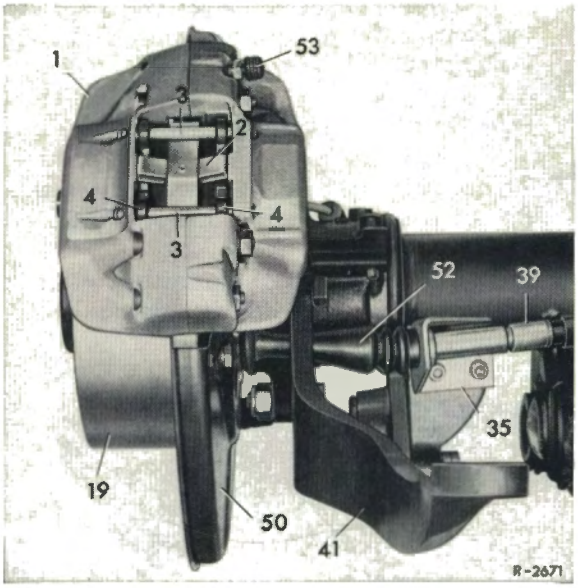


Fig. 42-7/28

Arrangement on Model 300 SEL

1 Brake caliper	39 Brake cable
2 Cross leaf spring	41 Brake support lever
3 Locking pin	50 Cover plate
4 Friction pad	52 Rubber sleeve
19 Brake disk	53 Bleed screw with rubber cap
35 Cable bracket	

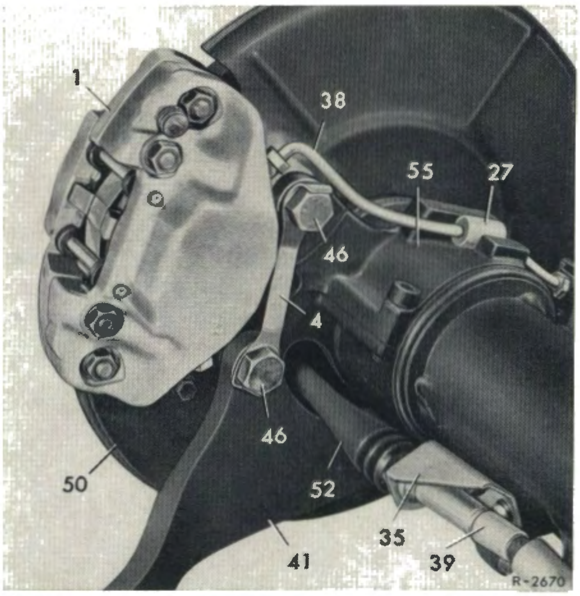


Fig. 42-7/29

Arrangement on Model 300 SEL

1 Brake caliper	41 Brake support lever
4 Locking plate	46 Hexagon fitting screw
27 Rubber ring	50 Cover plate
35 Brake cable bracket	52 Rubber sleeve
38 Brake line	55 Bearing assembly
39 Brake cable	

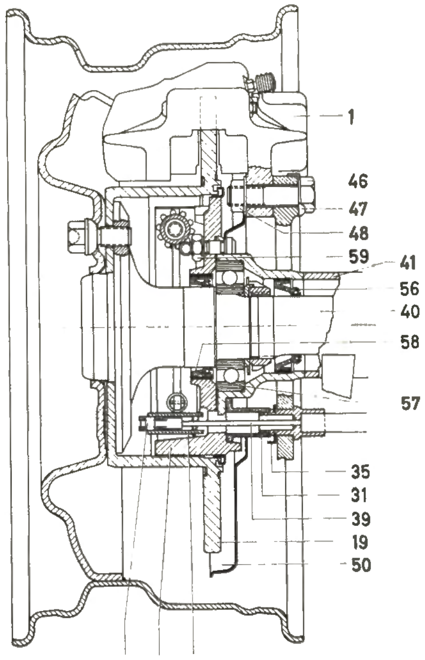


Fig. 42-7/30

1 Brake caliper
19 Brake disk
26 Expansion lock
29 Back plate
31 Rubber sleeve
33 Brake cable pin
35 KL Lock for brake cable
39 Brake cable
40 Rear axle shaft
41 Bearer tube
46 Hexagon fitting screw
47 Locking plate
48 Bracket with weld-on nut
50 Cover plate
56 Sealing ring
57 Annular grooved bearing
58 Sealing ring
59 Fitting screw with lock washer and hexagon nut

Job No.
42-8

Removal and Installation of Front Brake Shoes

Modification: Anchor Pin Stop in Wheel Brake Cylinder

A. Brake Shoes with Mechanical Adjustment

Removal:

1. After jacking up the car, remove the brake drum, if necessary by means of the three puller screws 191 589 00 35.

2. Detach the two return springs by means of Brake Spring Pliers 000 589 01 37.

Note: Put a suitable pad under the brake spring pliers to prevent damage to the brake lining.

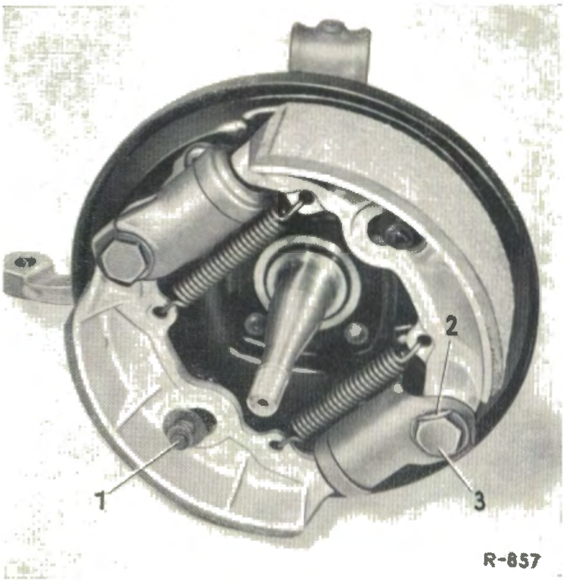


Fig. 42-8/2

1 Hexagon screw
2 Locking plate
3 Anchor pin

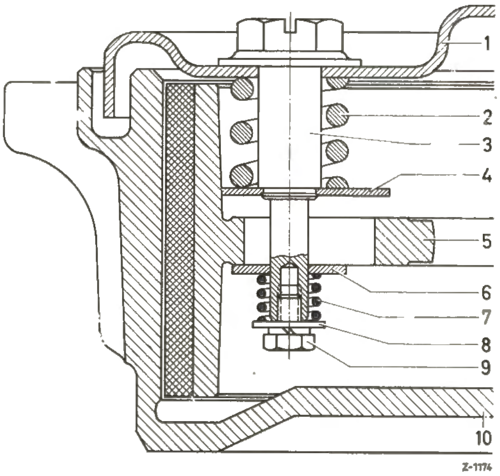


Fig. 42-8/1

1 Brake anchor plate	6 Washer
2 Pressure spring	7 Pressure spring
3 Adjustment bolt	8 Washer
4 Eccentric plate	9 Hexagon screw
5 Brake shoe	10 Brake drum

3. Screw out the hexagon screw (9), and remove the washer (8), the spring (7), and the washer (6) (Fig. 42-8/1).

4. Screw out the stop screw (2) (Fig. 42-8/3).

Note: Since in the 2nd version of the brake shoe suspension the anchor pin stop (5) is located in the wheel brake cylinder, it is not necessary to screw out the hexagon screw (2) (Fig. 42-8/4).

5. Bend the locking plate (6) upward and screw out the anchor pin (5) from the eye of the brake wheel cylinder (4) (Fig. 42-8/3 and 42-8/4).

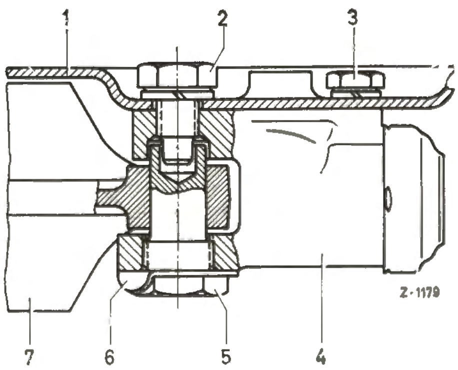


Fig. 42-8/3

1st Version

1 Brake anchor plate	5 Anchor pin
2 Stop screw	6 Locking plate
3 Hexagon screw	7 Brake shoe
4 Brake wheel cylinder	

6. Remove the brake shoe.

7. Follow the same procedure in removing the second brake shoe.

8. Remove the retaining pins from the brake wheel cylinders.

9. Clean brake shoes and brake anchor plate thoroughly with compressed air.

Installation:

10. Press the retaining pin into the brake wheel cylinder and install the brake shoe in the brake anchor plate.

11. Place the locking plate (6) over the anchor pin (5) and screw in the anchor pin (Fig. 42-8/3).

12. Secure the anchor pin with the locking plate.

13. Screw in and tighten the stop screw (2) (Fig. 42-8/3).

14. First place in position the large washer (6), the pressure spring (7), and then the small washer (8) and screw in the hexagon screw (9) until it is positioned against the adjustment bolt (3) (see Fig. 42-8/1).

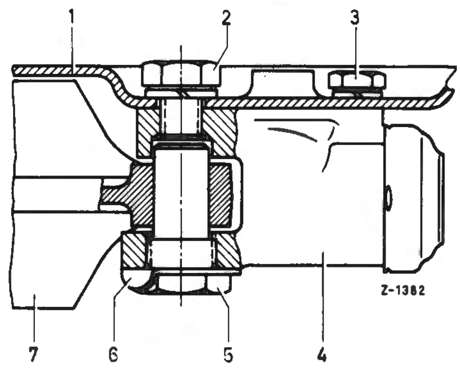


Fig. 42-8/4

2nd Version

1 Brake anchor plate
2 Hexagon screw
3 Hexagon screw
4 Wheel brake cylinder
5 Anchor pin
6 Locking plate
7 Brake shoes

Note: The purpose of the pressure spring (8) is to press the brake shoe against the contact plate of the brake anchor plate.

15. Attach the return springs.

16. Install the brake drum and the wheel.

17. Adjust the brakes (see Job No. 42-20, Section A).

18. Jack down the car.

B. Brake Shoes with Automatic Adjustment

Removal:

1. After jacking up the car, remove the brake drum, if necessary by means of the three puller screws 191 589 00 35.

2. Detach the two return springs by means of Brake Spring Pliers 000 589 01 37.

Note: Put a suitable pad under the brake spring pliers to prevent damage to the brake lining.

3. Remove the cotter pin (3) of the guide pin (14) at the back of the brake anchor plate and take off the washer (2). Then pull out the guide pin (14) together with the pressure spring (13) (Fig. 42-8/4).

4. Unscrew the bolt (4) of the automatic adjustment at the back of the brake anchor plate and remove together with the lock washer (1).

5. Screw out the stop screw (2) and remove it together with the lock washer (see Fig. 42-8/3).

Note: Since in the 2nd version of the brake shoe suspension the anchor pin stop (5) is located in the wheel brake cylinder, it is not necessary to screw out the hexagon screw (2) (Fig. 42-8/4).

6. Bend the locking plate (6) upward and screw out the anchor pin (5) from the eye of the brake wheel cylinder (see Fig. 42-8/3).

Note: The anchoring of the brake shoe on the brake wheel cylinder is the same for both eccentric and automatic adjustment.

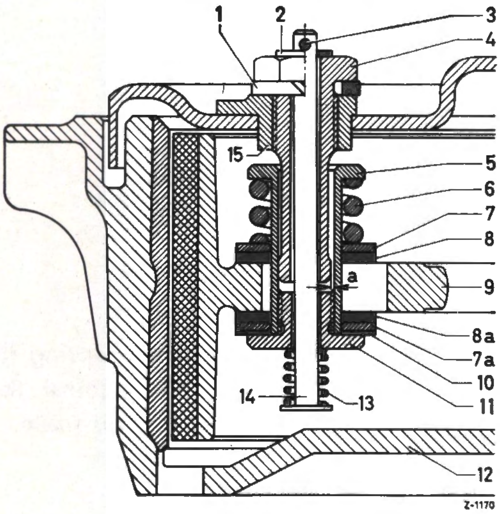


Fig. 42-8/5

1 Lock washer	9 Brake shoe
2 Washer	10 Washer
3 Cotter pin	11 Tensioning screw
4 Bolt	12 Brake drum
5 Adjusting sleeve	13 Pressure spring
6 Pressure spring	14 Guide pin
7 and 7a Thrust washers	a = clearance
8 and 8a Friction washers	

7. Remove the brake shoe.

8. Follow the same procedure in removing the second brake shoe.

9. Remove the retaining pins from the brake wheel cylinders.

10. Clean brake shoes and brake anchor plate thoroughly with compressed air.

Installation:

11. When reinstalling the brake shoes, the automatic adjustment and the clearance must be carefully checked. Use a sturdy screw driver to press the brake shoes outward and inward several times against the resistance of the automatic adjustment. The brake shoes must remain stationary in any position, even when they are forced outward as far as they will go. To check, lightly tap the sides of the brake shoes. **On no account must the return spring overcome the frictional resistance of the automatic adjustment and pull the brake shoes inward.**

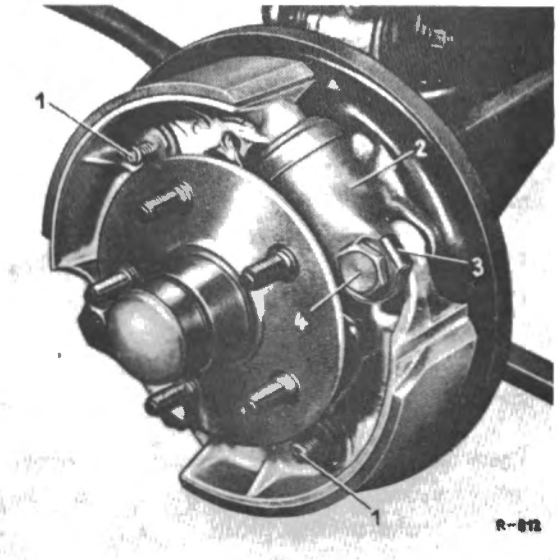


Fig. 42-8/6

1 Guide pin	3 Locking plate
2 Brake wheel cylinder	4 Anchor pin

12. Check the clearance too with a large screw driver. When the brake shoe is released from its outward position, you should be able to hear the click produced by the adjusting sleeve striking against the bolt. Watch for bent bolts. Comple clearance is indispensable, since otherwise the brake may not release if it is subjected to much stress.

13. Before installing the brake drums, push the brake shoes as far in as they will go.

14. Before starting the car, and during the test run, depress the brake hard several times, so that the brake shoes can adjust themselves completely.

Note: Do not on any account fail to depress the brake pedal several times before starting the car because the brakes will not operate until the brake shoes have adjusted themselves.

Removal and Installation of Rear Brake Shoes

Job. No.
42-9

Modification: Installation instructions supplemented and extended

A. Brake Shoes with Mechanical Adjustment, 1st and 3rd Versions

Malleable cast iron brake shoes 50 and 65 mm wide

Removal:

1. After jacking up the car, remove the brake drum, if necessary by means of the three puller screws 191 589 00 35.

2. Detach the return spring for the brake shoes and the return spring for the brake lever.

Note: Put a suitable pad under Brake Spring Pliers 000 589 01 37 to prevent damage to the brake lining.

3. Pull out the cotter pin (10) from the adjustment bolt (1). Then remove the washer (9) together with the pressure spring (8) and the washer (7) (Fig. 42-9/1).

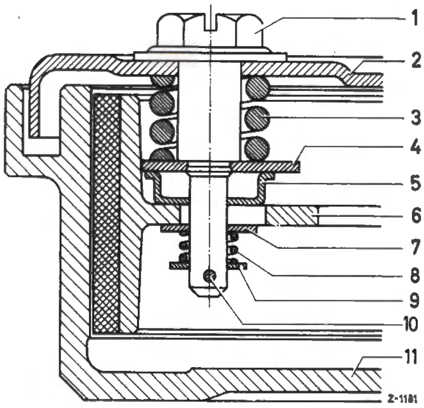


Fig. 42-9/1

Arrangement of the 50 mm brake

1 Adjustment bolt
2 Brake anchor plate
3 Pressure spring
4 Eccentric plate
5 Cup washer
6 Brake shoe
7 Washer
8 Pressure spring
9 Washer
10 Cotter pin
11 Brake drum

4. Screw out the hexagon screw for the brake shoe attachment from the anchor pin and remove it together with the lock washer, the steel washers, and the brass washer.

5. Detach the two brake shoes from the anchor pin and the rear brake cable from the brake lever.

6. Detach the pressure spring from the anchor pin.

Note: In order to prevent the pistons and cups from dropping out of the brake wheel cylinder, it is advisable to fit a Piston Clamp 000 589 02 37.

7. Clean brake shoes and brake anchor plate thoroughly with compressed air.

Installation:

8. Put the cup washer (5) on the adjustment bolt (1) (Fig. 42-9/1).

Note: On the 65 mm rear wheel brake an additional washer (7a) has been installed between the cup washer (5) and the brake shoe (6) (Fig. 42-9/2).

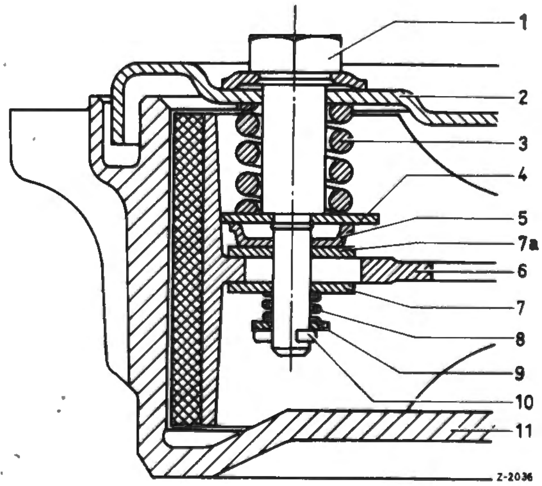


Fig. 42-9/2

Arrangement of the 65 mm brake

1 Adjustment bolt
2 Brake anchor plate
3 Pressure spring
4 Eccentric plate
5 Cup washer
6 Brake shoe
7 Washer
7a Washer
8 Pressure spring
9 Washer
10 Cotter pin
11 Brake drum

9. Lightly grease the anchor pin (9) and slide the pressure spring (7) onto the anchor pin. Tension the pressure spring by means of Spring Clamp 180 589 01 37 (Fig. 42-9/3).

10. Install the brake shoes making sure that the brake lever strut for the hand brake properly engages the pin of the front brake shoe and that the washers are installed in their proper sequence.

Note: Arrangement of washers on 50 mm brake shoes: Washer (6) must be installed between the outer brake shoe (4) and the brass washer (3). The pressure spring (7) rests directly against the inner brake shoe (5) (Fig. 42-9/3).

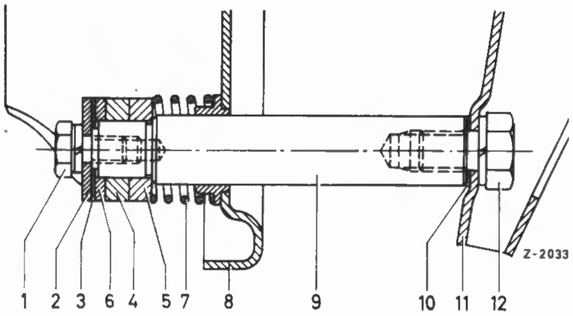


Fig. 42-9/3

1 Hexagon screw	7 Pressure spring
2 Washer	8 Brake anchor plate
3 Brass washer	9 Anchor pin
4 Outer brake shoe	10 Shim
5 Inner brake shoe	11 Bracket
6 Washer	12 Hexagon screw

Arrangements of washer on 65 mm brake shoes: Washer (6) must be installed between the inner brake shoe (5) and the pressure spring (7). The brass washer (3) rests directly against the outer brake shoe (Fig. 42-9/4).

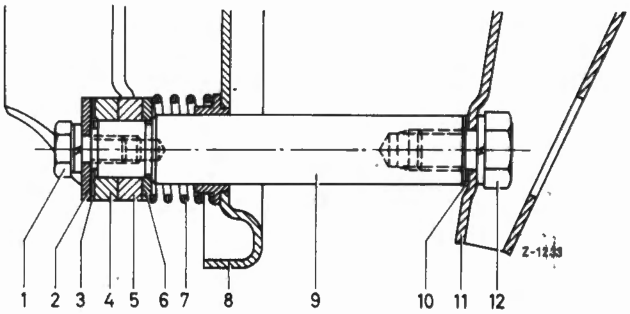


Fig. 42-9/4

1 Hexagon screw	7 Pressure spring
2 Washer	8 Brake anchor plate
3 Brass washer	9 Anchor pin
4 Outer brake shoe	10 Shim
5 Inner brake shoe	11 Bracket
6 Washer	12 Hexagon screw

11. Put on the brass washer (3) and screw in the hexagon screw (1) together with lock washer and washer (2). Remove the spring clamp (Fig. 42-9/4).

12. Install washer (7), pressure spring (8), and washer (9) on the adjustment bolt and cotter (Fig. 42-9/1).

Note: Make sure that the actuating pins of the wheel cylinders properly engage the brake shoes.

13. Attach the return spring for the brake shoes and the return spring for the brake lever.

14. Adjust the brakes (see Job No. 42-20, Sections A to C).

B. Brake Shoes with Mechanical Adjustment, 2nd Version

Light-metal brake shoes 65 mm wide

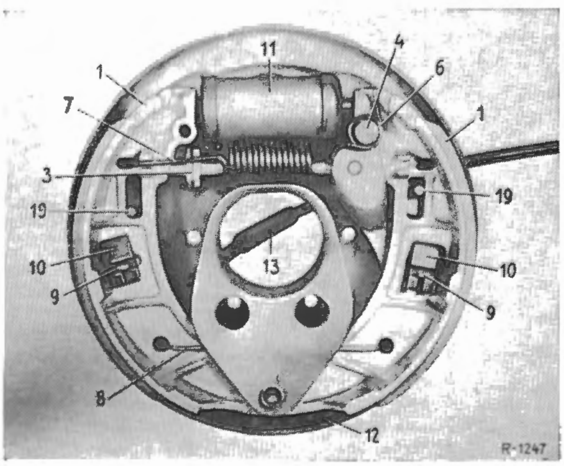


Fig. 42-9/5

1 Brake shoes	9 Retaining pin
3 Push rod	10 Flat shaped spring
4 Collar bolt	11 Wheel cylinder
6 Brake lever spring	12 Brake anchor plate
7 Upper return spring	13 Brake cable
8 Lower return spring	14 Eccentric plate

Removal:

1. Detach the upper and lower return springs (7) and (8) (Figs. 42-9/5 and 42-9/6).

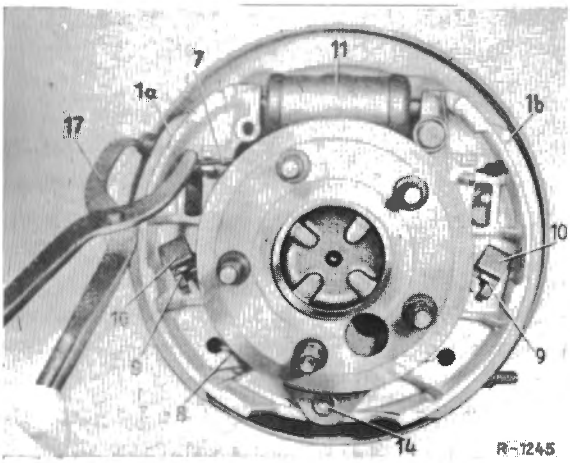


Fig. 42-9/6

1a Front brake shoe
1b Rear brake shoe
7 Upper return spring
8 Lower return spring
9 Retaining pin
10 Flat shaped spring
11 Wheel cylinder
14 Brake shoe anchor pin
17 Brake spring pliers

2. Remove the two flat shaped springs (10) using a pair of pliers to turn the retaining pin (9) until the flat shaped spring can be taken out. Then take the retaining pins out of the brake anchor plate (Fig. 42-9/7).

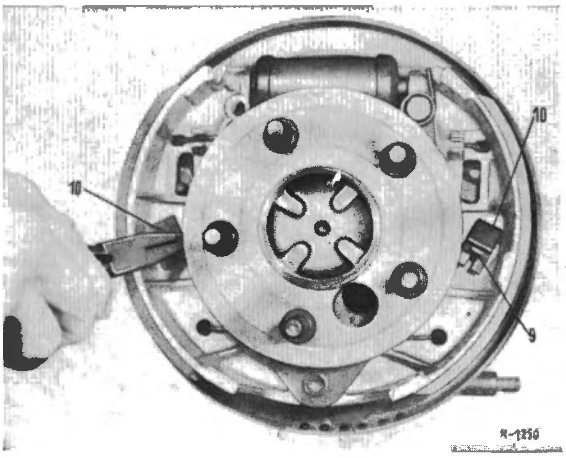


Fig. 42-9/7

9 Retaining pin
10 Flat shaped spring

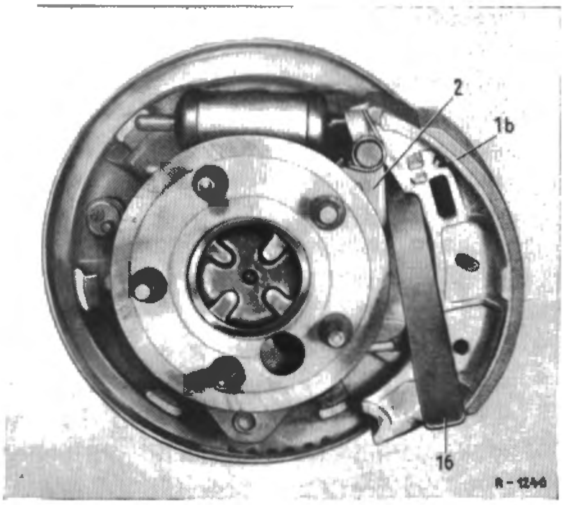


Fig. 42-9/8

1b Rear brake shoe
2 Brake lever
16 Spreader

3. Turn the two eccentrics (19) on the brake anchor plate until the brake shoes are in their extreme outward position (Fig. 42-9/2).

4. Insert the spreader (16) between the brake shoes (1b) and the brake lever (2) (Fig. 42-9/8).

Note: It is advisable to use a piece of flat iron about 15 mm wide as a spreader.

5. First remove the rear brake shoe and then the front brake shoe.

6. Remove the cotter pin from the collar bolt (4). Take the collar bolt out of the brake shoe paying attention to the sleeve (5) and the return spring (6). Remove the brake lever with push rod and return spring (Fig. 42-9/9).

7. Screw the push rod (3) out of the brake lever (2). Remove the upper return spring (7) from the push rod (Fig. 42-9/9).

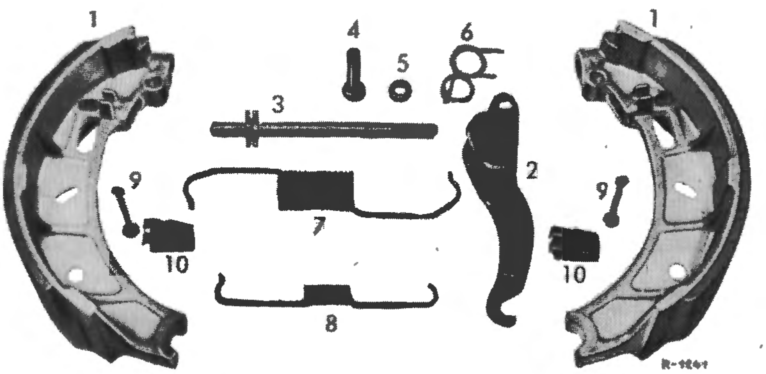


Fig. 42-9/9

1 Brake shoes
2 Brake lever
3 Push rod
4 Collar bolt
5 Sleeve
6 Return spring
7 Upper return spring
8 Lower return spring
9 Retaining pin
10 Flat shaped spring

Installation:

8. Lightly coat the threads of the push rod (3) with Molycote Paste Type 'G'. Put the upper return spring (7) on the push rod in such a way that the long coil end points towards the push rod thread. Screw the push rod completely into the brake lever (2) (Fig. 42-9/9).

9. Attach the brake lever (2) with the push rod (3) and the return springs (6) and (7) to the rear brake shoe. Make sure that the return spring (6) is correctly positioned (see Figs. 42-9/9 and 42-9/10).

10. Attach the return spring (7) to the brake shoe (1) and lock by means of the retaining pin (15) (Fig. 42-9/10).

Note: Instead of the retaining pin (15) also a drift can be used for locking the return spring.

If the spring is not locked in position it may become detached when the brake shoes are installed. As the spring engages the brake shoe at the rear, reattachment of the spring is very difficult when the brake shoes are installed.

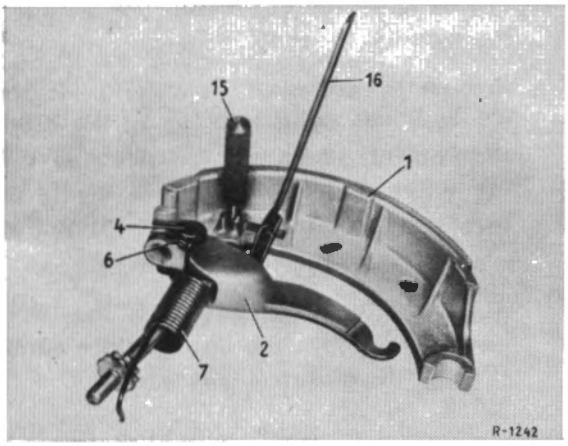


Fig. 42-9/10

1 Brake shoes
2 Brake lever
4 Collar bolt
6 Brake lever spring
7 Upper return spring
15 Retaining pin
16 Spreader

11. Insert the spreader (16) between the brake shoe and the brake lever (2), attach the brake cable and install the brake shoes in the brake anchor plate. Then remove the spreader (Fig. 42-9/10).

Note: When inserting the spreader excessive tensioning of the return spring (6) should be avoided.

12. Lightly rub the anchor pin (14) and the contact surfaces (18) for the brake shoes with Molycote Paste Type 'G' (Figs. 42-9/6 and 42-9/11).

13. Insert the front brake shoe (1a) in the brake anchor plate (Fig. 42-9/6).

14. Turn the two eccentrics (19) until the brake shoes (1) are in their extreme inward position. In doing this make sure that the pressure pins of the wheel cylinder (11) engage the brake shoes properly (see Fig. 42-9/5).

15. Install retaining pins (9) into the brake anchor plate, place the flat shaped spring (10) on the retaining pin, compress it and turn the retaining pin by 90° (Fig. 42-9/12).

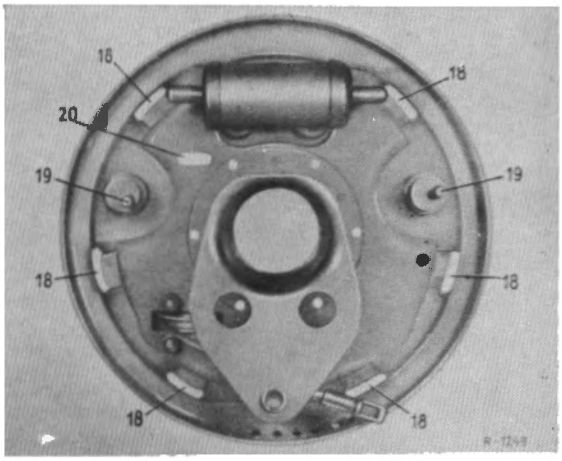


Fig. 42-9/11

18 Contact surfaces for brake shoes
19 Eccentric
20 Slotted hole in the brake anchor plate

16. Attach the upper return spring (7) (Fig. 42-9/5).

Note: The return spring must be positioned between the spring guides of the brake shoe.

17. Remove the retaining pin for the return spring from the rear brake shoe.

18. Attach the lower return spring (8) (Fig. 42-9/12).

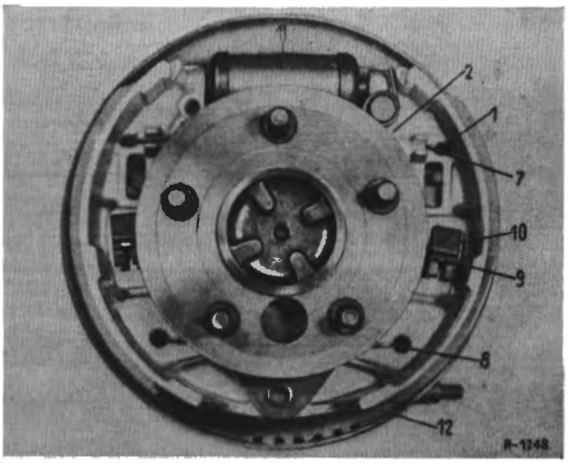


Fig. 42-9/12

1 Brake shoes	9 Retaing pin
2 Brake lever	10 Flat shaped spring
7 Upper return spring	11 Wheel cylinder
8 Lower return spring	12 Brake anchor plate

Note: The curved end of the return spring must be attached to the front brake shoe. If the spring is installed in the wrong position the curved end may rub against the brake lever (Fig. 42-9/13).

Fig. 42-9/13

19. Check whether the pins of the wheel cylinder and the push rod engage the brake shoes properly. Make sure that the return springs are properly seated.

20. Install the brake drums and the road wheels.

21. Adjust the brakes (see Job No. 42-20).

C. Brake Shoes with Automatic Adjustment

Removal:

1. After jacking up the car, remove the brake drums, if necessary by means of the three puller screws 191 589 00 35.

2. Detach the return spring for the brake shoes and the return spring for the brake lever.

Note: Put a suitable pad under Brake Spring Pliers 000 589 01 37 to prevent damage to the brake lining.

3. Pull out the cotter pin (4) from the guide pin (3) of the automatic adjustment. Remove the washer (2), then the guide pin (3) together with the spring (5) on both brake shoes (11) (Fig. 42-9/14).

Note: Since the cotter pin (4) is difficult to get at, the guide pin can be installed the opposite way. The guide pin is now installed from behind and the cotter pin with the washer is put on from the front (Fig. 42-9/14).

4. Unscrew the hexagon screw (1) for the brake shoe attachment from the anchor pin (9), and remove together with the lock washer, the washer (2) and brass washer (3) (Fig. 42-9/15).

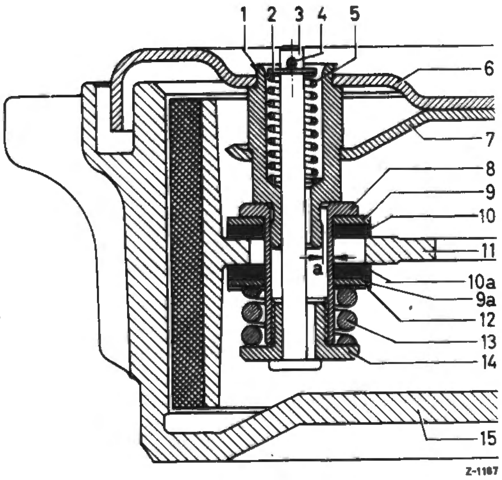


Fig. 42-9/14

1 Bolt	9 and 9a Thrust washer
2 Washer	10 and 10a Friction washer
3 Guide pin	11 Brake shoe
4 Cotter pin	12 Washer
5 Pressure spring	13 Pressure spring
6 Brake anchor plate	14 Tensioning screw
7 Bow	15 Brake drum
8 Adjusting sleeve	a = Clearance

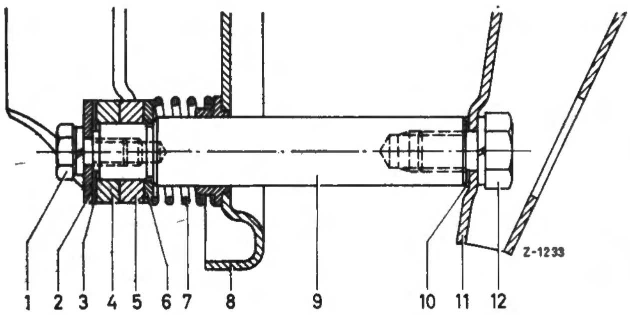


Fig. 42-9/15

1 Hexagon screw
2 Washer
3 Brass washer
4 Outer brake shoe
5 Inner brake shoe
6 Washer
7 Pressure spring
8 Brake anchor plate
9 Anchor pin
10 Shim
11 Bracket
12 Hexagon screw

5. Remove both brake shoes from the anchor pin and detach the rear brake cable from the brake lever.
   Then remove the washer (6) and the pressure spring (7) from the anchor pin (see Fig. 42-9/15).

6. Remove the two spring-loaded pins from the brake wheel cylinder (Fig. 42-9/16).

Note: In order to prevent the pistons and cups from dropping out of the brake wheel cylinder it is advisable to fit a Piston Clamp 000 589 02 37.

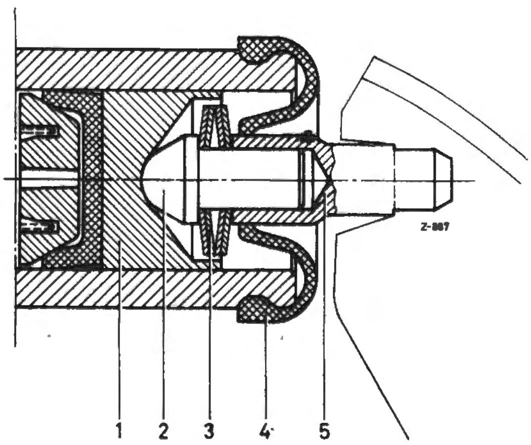


Fig. 42-9/16

1 Piston
2 Pin
3 Cup spring
4 Boot
5 Guide pin

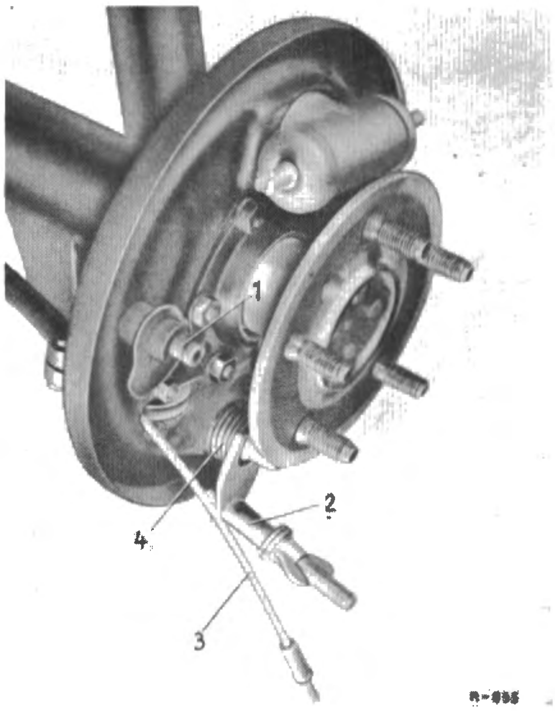
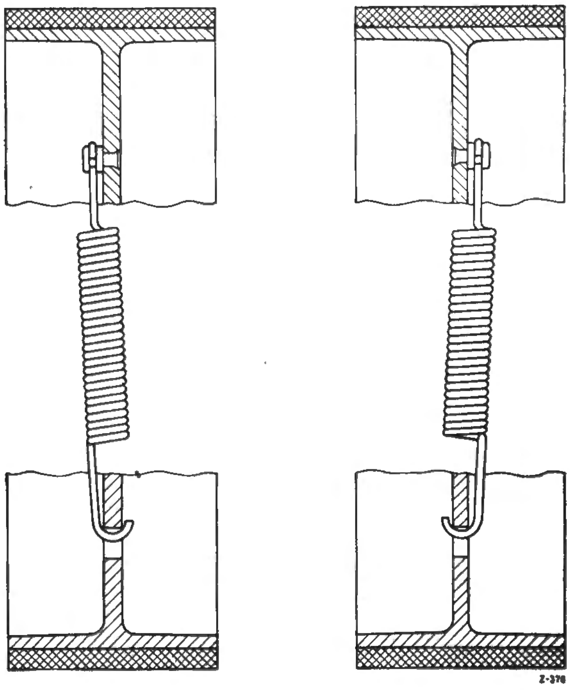


Fig. 42-9/17

1 Bolt
2 Spring clamp
3 Brake cable
4 Pressure spring

7. Remove the pin (2) from the guide pin (5) and check the cup springs (3) for initial tension. When reassembling, coat the contact surface of the pin lightly with Molykote Paste Type "G" (Fig. 42-9/16).



left right

Fig. 42-9/18

Note: In order to shorten the brake pedal travel, the cup springs in the spring-loaded pressure pin have been changed. The new cup springs have an external diameter of 15 mm instead of the 20 mm diameter of the 1st version springs.

8. Clean brake shoes and brake anchor plate thoroughly with compressed air.

Installation:

9. When reinstalling the brake shoes, compress the pressure spring (4) with Spring clamp (2) 180 589 01 37 (Fig. 42-9/17).

10. Make sure that the proper return spring is used. The right and left return spring are shaped differently (Fig. 42-9/18).

11. Check the automatic adjustment and the clearance (see Job No. 42-8, Section B, paras 11-14).

12. Adjust the hand brake (see Job No. 42-20, Section C).

Note: Do not fail to depress the brake pedal several times before Driving the car away because the brakes will not operate unless the correct clearance is obtained.

Replacement of Friction Pads

Job. No.
42-10

*Modification: Section A supplemented (see *), Disk Brake Make Dunlop added*

A. Make Girling

The friction pads have to be replaced when the lining thickness is 2 mm or less or when the friction pads are oily or greasy.

Removal:

1. Pull the spring clips (7) out of the retaining pins and remove the retaining pins from the brake caliper (3) and the frictions pads (6) (Fig. 42-10/1).

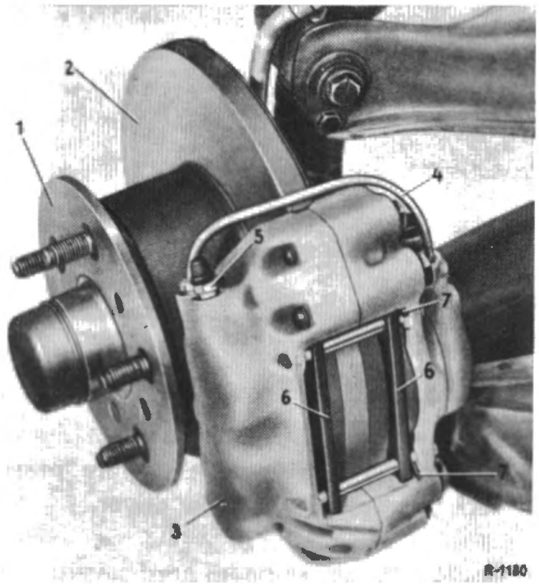


Fig. 42-10/1

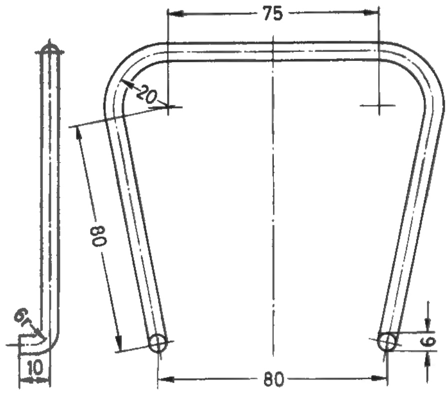
1 Front wheel hub
2 Brake disk
3 Brake caliper
4 Connecting line
5 Bleed screw
6 Friction pad
7 Spring clip

2. Use a hook (see Fig. 42-10/2) to lift the friction pad (1) out of the brake caliper (Fig. 42-10/3).
   The hook should be made in the shop in accordance with the measurements given in Fig. 42-10/2.

* **Note**: On the 2nd and 3rd versions, heat screening plates have been arranged between the pistons and the friction pads in order to protect the dust caps.

3. Thoroughly clean the brake caliper with compressed air.

4. Push the pistons back into their end position by means of the piston return lever (3) (Fig. 42-10/4).



Stretchod length = 320 Z-2200

Fig. 41-10/2

Note: In order to prevent overflowing of the fluid reservoir when the pistons are being pushed back, a certain amount of brake fluid should be drained beforehand.

* On the 2nd and 3rd versions of the brake caliper, care should be taken to ensure that the heat screening plates are not damaged or dented when the pistons are being forced back. Before forcing back the piston remove the screening plate on the inner pressure cylinder. The screening plate on the outer pressure cylinder cannot be removed and must therefore be put against the brake disk.

Installation:

5. Install new friction pads in the caliper aperture, install the retaining pins and secure by spring clips.

Note: Make sure that the dust caps are properly seated in the annular groove of the pressure cylinder and the piston. If the dust cap is not properly seated in the annular groove of the cylinder, the brake caliper must be removed and the piston must be withdrawn from the brake caliper (see Job No. 42-12).

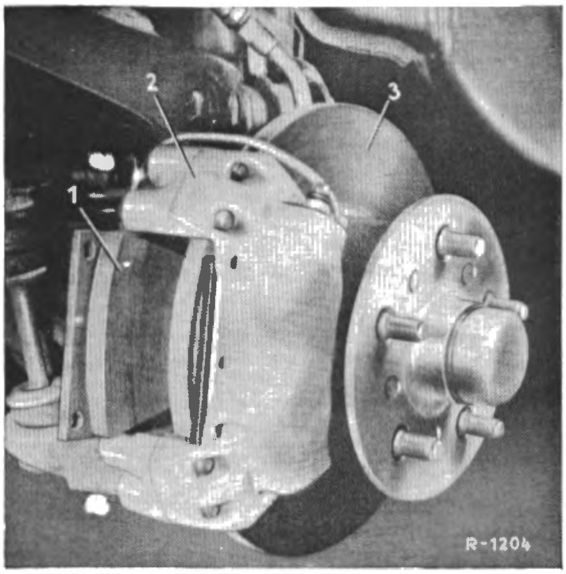


Fig. 42-10/3

1 Friction pad
2 Brake caliper
3 Brake disk

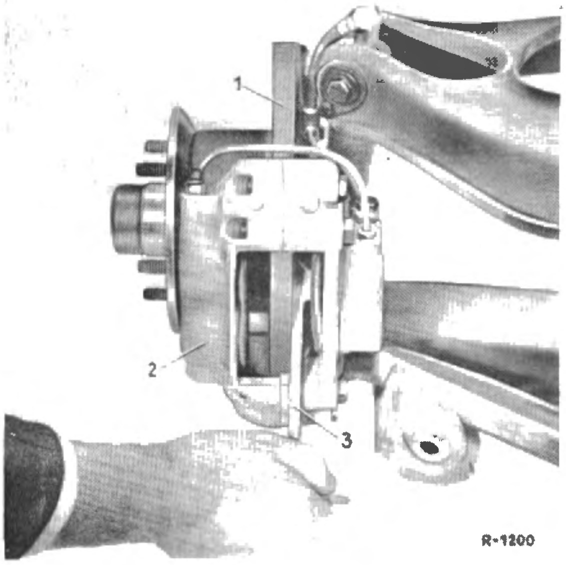


Fig. 42-10/4

1 Friction pad
2 Brake caliper
3 Piston return lever

* Grooved friction pads are available for special requirements which prevent uneven braking of the disk brake on rainy road surfaces.

* When installing the retaining pins make sure that the dust cap of the outer caliper

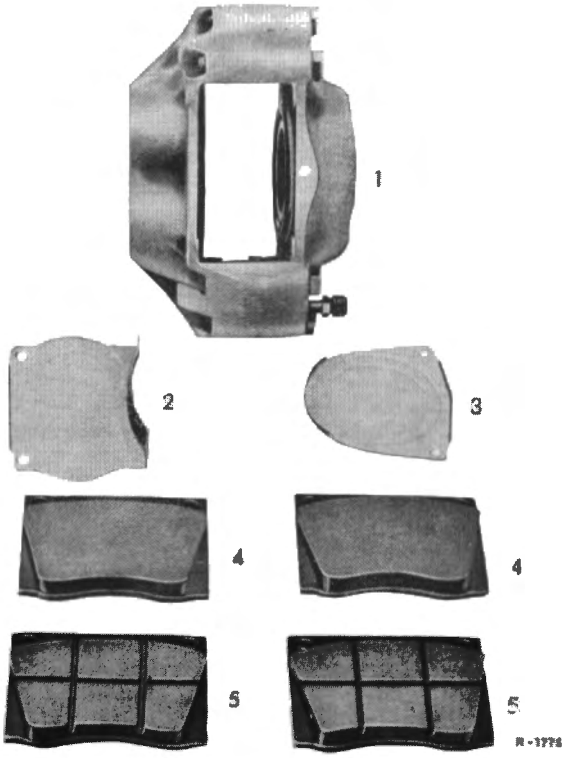


Fig. 42-10/5

1 Brake caliper
2 Outer heat screening plate
3 Inner heat screening plate
4 Friction pad Part No. 000 421 01 08
5 Grooved friction pad Part No. 000 421 03 08

half is not damaged. To prevent damage the dust cap should be slightly pressed back by means of a screw driver.

6. Depress the brake pedal hard several times until a solid resistance is felt. Then check and if necessary top up the level of the brake fluid in the fluid reservoir.

Note: Do not on any account omit to actuate the brake pedal, since the brakes will not operate unless the friction pads make contact with the brake disk.

7. When the friction pads have been replaced they should be carefully run in by braking the car several times from 80 to 40 km/h and the car should be braked to a complete stop only after the brake system has cooled down and even then deceleration should be gradual.

Note: Under emergency braking conditions the lining surface of new friction pads is liable to scar and as a result the car will brake unevenly.

B. Make Dunlop (Service Brake)

Modification: Fig. 42-10/8 modified, dismantling tool and Section C added

Note: Friction pads should be replaced when they are worn down to approx. 6 mm or when they are greasy.

Removal:

1. Unscrew the hexagon screw for fastening the stirrup (10) and remove together with the stirrup (Fig. 42-10/7).

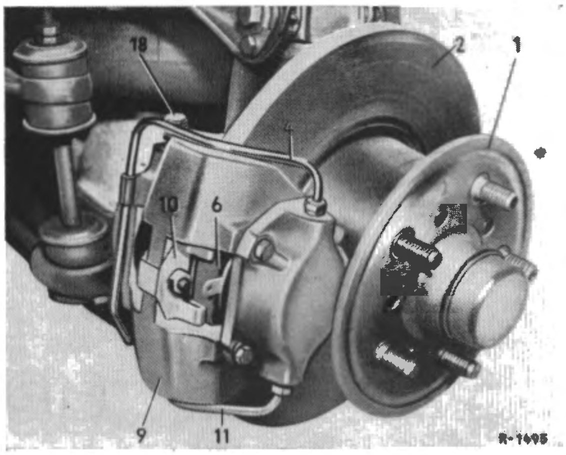


Fig. 42-10/6

1 Front wheel hub
2 Brake disk
4 Connecting line
6 Friction pad
9 Brake caliper
10 Stirrup
11 Brake line
18 Bleed screw

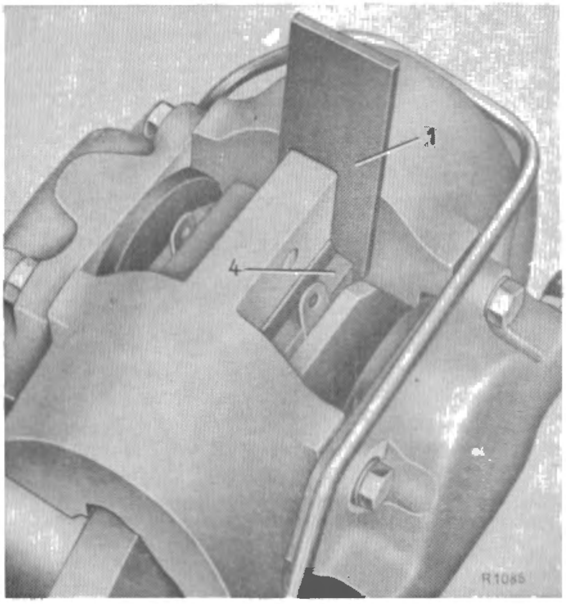


Fig. 42-10/7

1 Friction pad control gage 001 589 02 21 00
4 Friction pad

Note: The friction pad control gage can be bought from our works or it can be made in accordance with measurements given in Fig. 42-10/8.

The friction pad control gage has been changed in order to make measuring of the friction pad thickness possible without removal of the stirrup (10).

2. Insert the friction pad control gage (1) in the brake caliper. If the gage tongue can be pushed to the back of the friction pad (4) the friction pad should be replaced (Fig. 42-10/7).

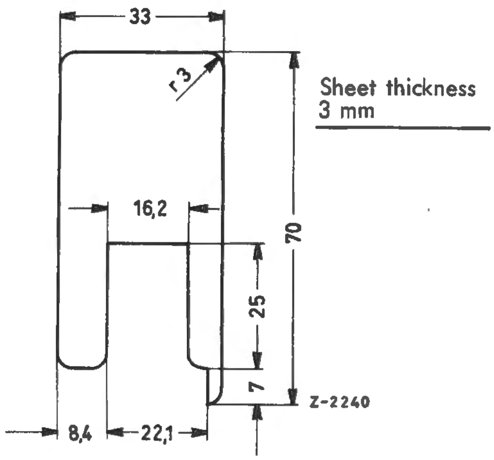


Fig. 42-10/8

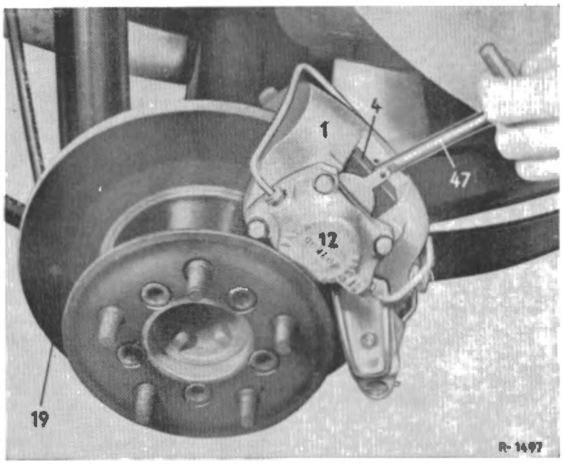


Fig. 42-10/9

1 Brake caliper
4 Friction pad
12 Pressure cylinder
19 Brake disk
47 Hook

3. Insert a hook (47) in the fitting plate of the friction pad (4) and pull the friction pad out of the aperture of the caliper (1) (Fig. 42-10/9).

Note: The dismounting tool can be made in the shop according to the dimensions given in Fig. 42-10/10. This tool can be used for Girling, Dunlop, and Teves brake calipers.

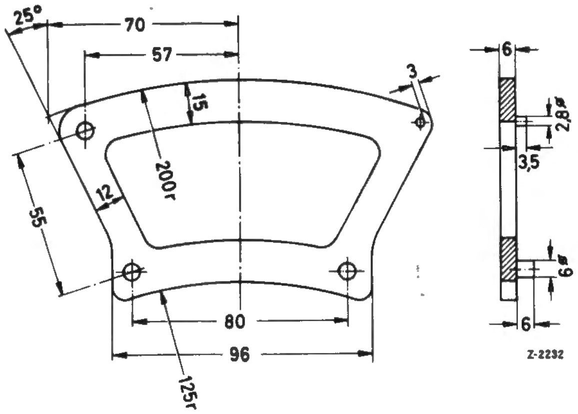


Fig. 42-10/10

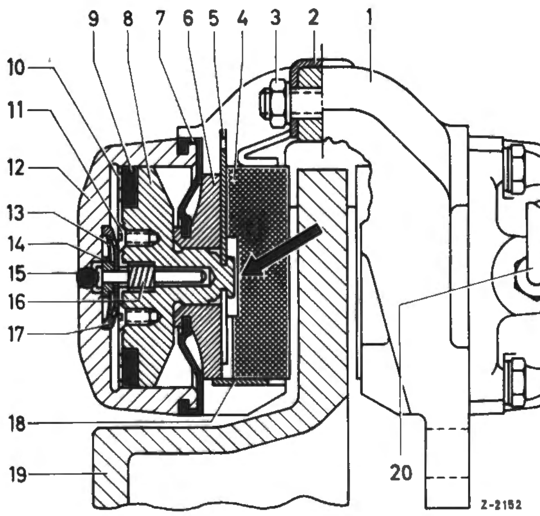


Fig. 42-10/11

1 Brake caliper	10 Piston plate
2 Stirrup	11 Countersunk screw
3 Hexagon screw with nut and serrated lock washer	12 Pressure cylinder
4 Friction pad	13 Paw spring
5 Fitting plate	14 Limiting bush
6 Lining pressure plate	15 Retaining pin
7 Dust cap	16 Friction spring
8 Piston with guide bolt	17 Spring disk
9 Piston seal	18 Retaining plate
	19 Brake disk
	20 Connecting line

4. Carefully clean the friction pad guide in the caliper and thoroughly blow out with compressed air.

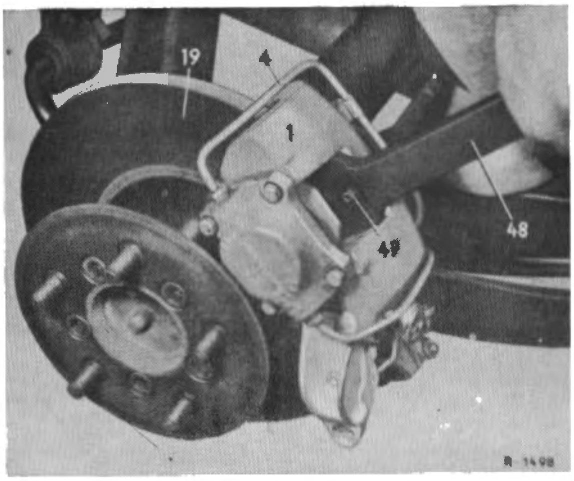


Fig. 42-10/12

1 Brake caliper	48 Piston return lever 000 589 28 63 00
4 Connecting line	49 Fixing pin
19 Brake disk	

5. Use piston return lever (48) or piston resetting tongs (48a) to push the piston in the pressure cylinder into its end position, making sure that the fixing pin (49) engages the bore for the hexagon screw (Figs. 42-10/11, 2 and 3).
Check the guide for the lining pressure plate in the caliper for binding and pressure marks. If any marks are found remove them with a scraper. Remove pressure marks on the guide quadrant of the lining pressure plate by means of fine-grain emery paper.

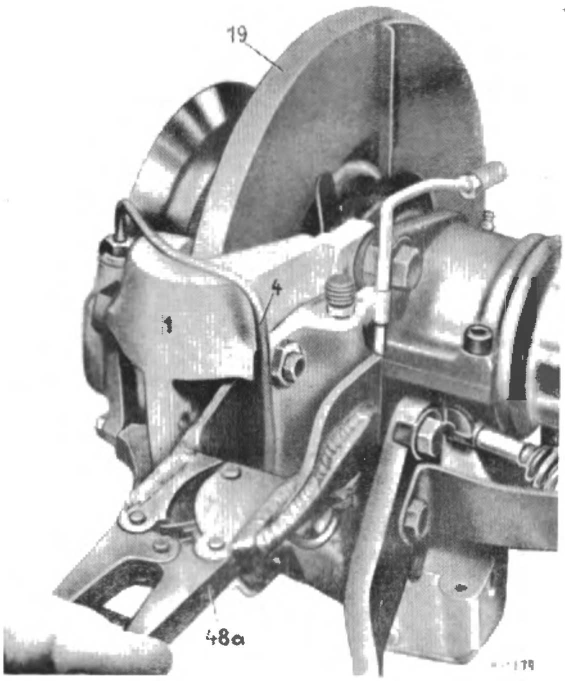


Fig. 42-10/13

1 Brake caliper	19 Brake disk
2 Connecting line	48a Piston resetting tongs

Check the dust cap for cracks. If cracks or other damage are found, remove the pressure cylinder and repair.

Note: In order to prevent overflowing of the fluid reservoir when the pistons are being pushed back, a certain amount of brake fluid should be drained beforehand.

Installation:

6. Install a new friction pad (4) in the guide bolt of the piston (8) **taking care to ensure that the friction pad together with its fitting plate (5) properly engages the guide bolt of the piston (see arrow in Fig. 42-10/11).**

Note: Before installing the friction pad, rub Molykote Paste "U" or graphite grease into the pad faces marked with arrows in Fig. 42-10/13a. Take care to ensure that the braking area of the friction pad is kept free from grease.

7. Attach the stirrup (10) to the caliper (9) and actuate the service brake several times so that the clearance between the friction pads and the brake disk can adjust itself (Fig. 42-10/6).

Note: Do not fail to depress the brake pedal
*** several times before driving the car away because the brakes will not operate unless the pistons have adjusted themselves with the friction pads.**

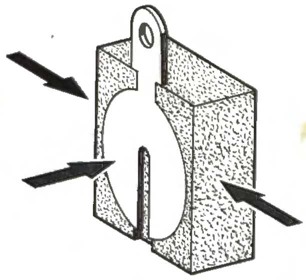
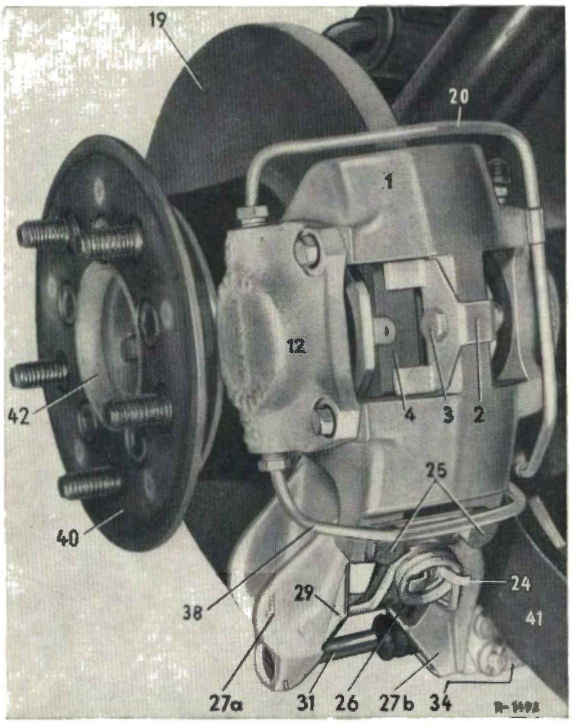


Fig. 42-10/13a

C. Make Dunlop (Hand Brake)

Note: The hand-brake friction pads have to be replaced when the lining thickness is worn down to approx. 4.5 mm (measured at the thinnest spot) or when the pads are greasy.



Removal:

1. Pull out the cotter pin on the outer lining carrier (27a) and back out the adjustment screw (31) several turns (Fig. 42-10/14).

2. Detach the leg spring (26) from the fitting plates of the friction pads (29) (Fig. 42-10/14).

3. Loosen the hexagon nut on the cheese head screw fastening the friction pads to the lining carriers.

Fig. 42-10/14

1 Brake caliper
2 Stirrup
3 Hexagon screw with hexagon nut and serrated lock washer
4 Friction pad with fitting plate (service brake)
12 Pressure cylinder
19 Brake disk
20 Connecting line with pipe clip
24 Locking plate
25 Swing bolt
26 Leg spring
27a Outer lining carrier
27b Inner lining carrier
29 Friction pad with fitting plate (hand brake)
31 Adjustment screw
34 Tension lever
38 Brake line
40 Wheel fixing disk
41 Brake support lever
42 Rear axle shaft

Note: The hexagon nut on the inner lining carrier can only be loosened by means of an offset box wrench.

4. Use a hook (47) to lift the friction pad (29) out of the lining carrier (27). Thoroughly clean the guide for the friction pad in the lining carrier (Fig. 42-10/15).

5. Back out the wing nut (8) on the relay lever (5) as far as it will go (Fig. 42-10/16).

Installation:

6. Install new friction pads (29) in the lining carriers (27a) and (27b) and tighten the hexagon nuts of the cheese head screws (Fig. 42-10/14).

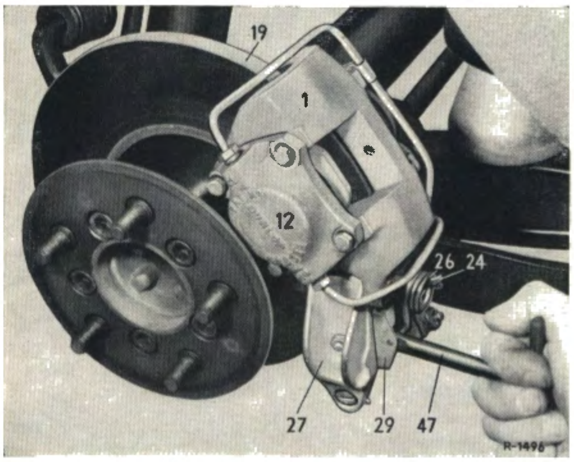


Fig. 42-10/15

1 Brake caliper
12 Pressure cylinder
19 Brake disk
24 Locking plate
26 Leg spring
27 Lining carrier
29 Friction pad with fitting plate
47 Hook

7. Attach the leg spring 26) to the fitting plates of the friction pads (28) (Fig. 42-10/15).

8. Screw in the adjustment screw (31) until there is a clearance of approx. 0.5 mm between the friction pads (29) and the brake disk (19). Then cotter the adjustment screw (Fig. 42-10/14).

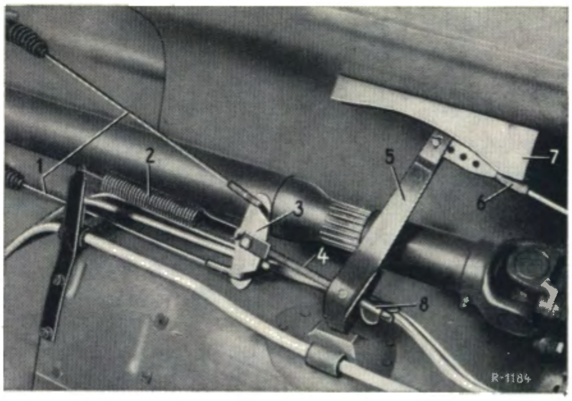


Fig. 42-10/16

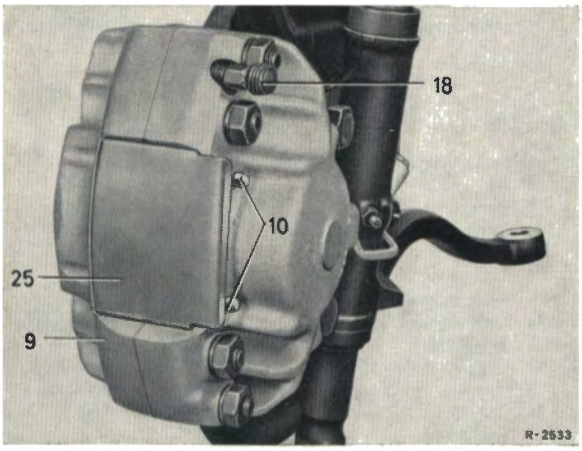
1 Rear brake cables
2 Return spring
3 Equalizer
4 Tensioning screw
5 Relay lever
6 Center brake cable
7 Relay lever guide
8 Wing nut for hand brake adjustment

Note: The cotter pin prevents turning of the adjustment screw during the adjustment process.

10. Actuate the hand brake several times in order to adjust the distance between the friction pads and the brake disk properly.

D. Make Teves (Service Brake)

Note: The friction pads have to be replaced when the lining thickness is worn down to 2 mm, or when the pads are greasy. Install only linings that are on the approved list.



Removal:

1. Remove the cover plate (25), if installed, from the brake caliper (9) of the front wheel brake (Fig. 42-10/17).

Fig. 42-10/17

9 Brake caliper
10 Locking pin
18 Bleed screw with rubber cap
25 Cover plate

2. Remove the locking clips on 1st version brake calipers where the lock pins (10) are secured with locking clips (21). Then drive the lock pins out of the brake caliper (9) and remove the crossleaf spring (23) (Fig. 42-10/23).

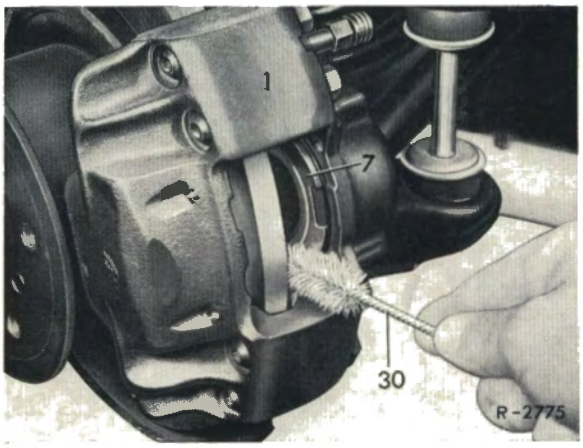


Fig. 42-10/18

1 Brake caliper
7 Heat screening plate
30 Cylindrical brush

3. On recent brake calipers, the lock pin (3) is secured in the brake caliper (1) by means of a clamping sleeve (3a). To remove the lock pin, drive it out outward with a 4–6 mm drift (Fig. 42-10/19).

4. Use the dismantling tool (30) to pull one friction pad (12) out of the gap of the brake caliper. Clean the guide for the friction pad in the brake caliper with a cylindrical brush (30) (Fig. 42-10/18).

Note: The dismantling tool should be made in the shop according to the dimensions given in Fig. 42-10/10.

3. Check the dust cap for cracks. If the dust cap is damaged the brake caliper must be removed and disassembled since dirt intrusions are liable to produce leaks in the brake caliper very quickly.

Note: If excessive friction pad wear is found in the front wheel brake, make the following checks:

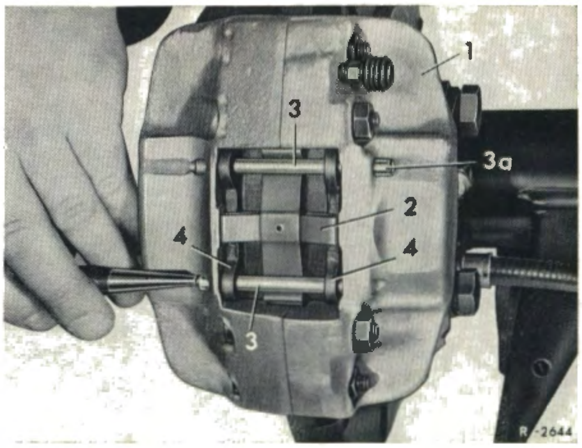


Fig. 42-10/19

1 Brake caliper
2 Crossleaf spring
3 Lock pin
3a Clamping sleeve
4 Friction pad

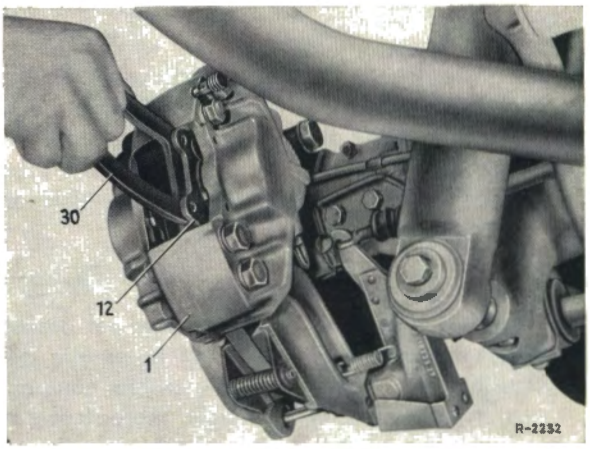


Fig. 42-10/20

1 Brake caliper 12 Friction pad 30 Dismantling tool

a) Check the pistons in the brake caliper for free movement. When pistons do not move freely or are seized, repair the brake caliper.

b) Install cover plates of the latest version. These cover plates (Part No. 111 420 04 44 left and Part No. 111 420 05 44 right) give the brake disk and the brake caliper a large measure of protection against water and dust.

c) Install the cover plate Part No. 000 421 02 20 (see para 12).

6. Use the piston resetting tongs (30) to push the piston back. Make sure that one friction pad always remains in the brake caliper since otherwise pushing back one piston would move the opposite piston forward (Fig. 42-10/21).

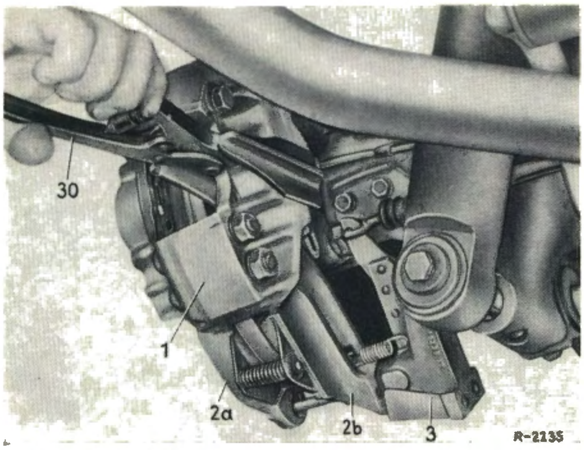


Fig. 42-10/21

1 Brake caliper
2a Outer lining carrier
2b Inner lining carrier
3 Tension lever
30 Piston resetting tongs

Note: In order to prevent overflowing of the reservoir when one piston is pushed back, a certain amount of brake fluid should always be drained from the reservoir of the brake master cylinder before the friction pads are replaced.

The brake calipers of the rear wheel brakes have been equipped with an automatic adjusting device and a disk-wobble compensator. As a result relatively more force is required to push the piston back.

7. Check the position of the screening plate (7) in the brake caliper (1). If necessary, slightly turn the piston (2) with piston turning tool 000 589 36 37 00 (Figs. 42-12/22 to 42-12/25).

Note: Dented heat screening plates should be replaced. To do this remove the brake caliper (see Job Nos. 42-7 and 42-12).

On Model 300 SE the brake caliper for the rear wheel brake is provided with a heat screening plate only on the outer piston.

Installation:

8. Install the friction pad and replace the second friction pad as described in para 4.

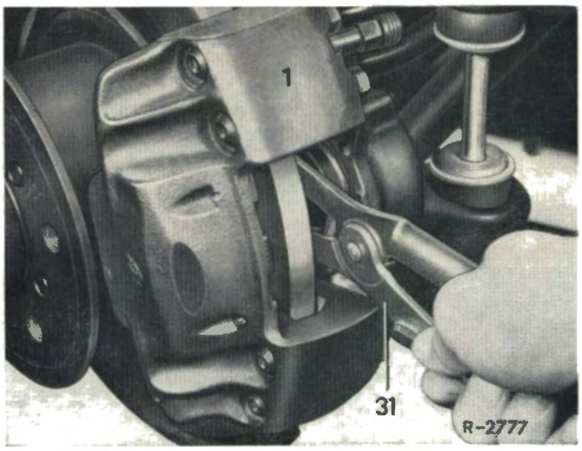


Fig. 42-10/22

1 Brake caliper
2 Piston
7 Heat screening plate
31 Piston turning tool

9. Rub Molykote Paste "U" on the points of the friction pad that are marked in Fig. 42-10/22a.

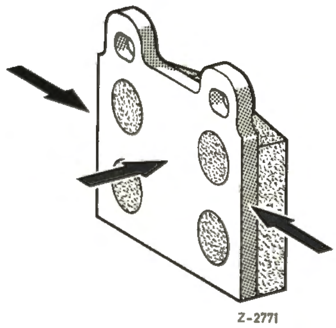


Fig. 42-10/22a

Note: The friction pads 1 for the front wheel brake have been provided with a rain groove. Friction pads without this groove can be remachined by means of a two-lipped 3 mm end mill. For groove width and depth see Fig. 42-10/26.

Cars with disk brakes on both front and rear axles must always be provided with the same quality pads.

10. On the 1st version brake calipers fit the crossleaf spring (23) and install the lock pin (10). Secure the lock pins by means of the locking clips (21) in such a way that the bent leg of the locking clip points outward (Fig. 42-10/23).

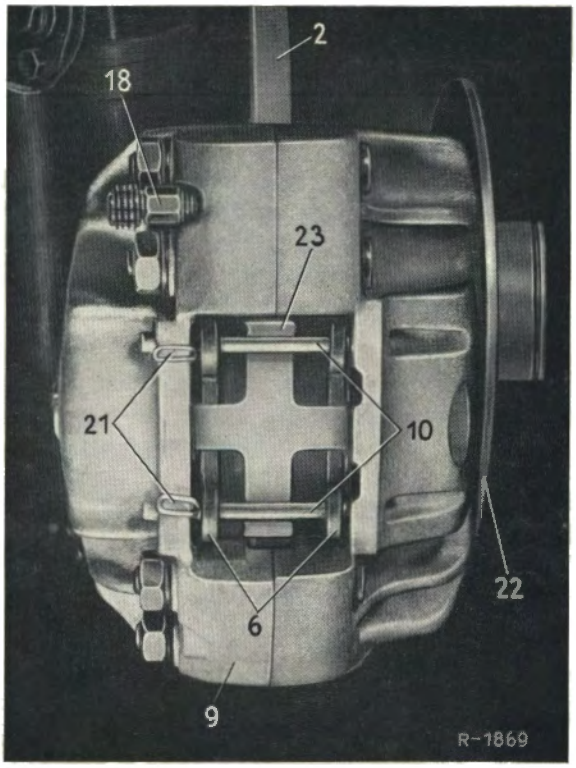


Fig. 42-10/23

2 Brake disk
6 Friction pad
9 Brake caliper
10 Lock pin
18 Bleed screw
21 Locking clip
22 Front wheel hub
23 Cross leaf spring

11. On recent brake calipers drive the lock pins (3) into the brake caliper (1) from the inside toward the outside (Fig. 42-10/24).

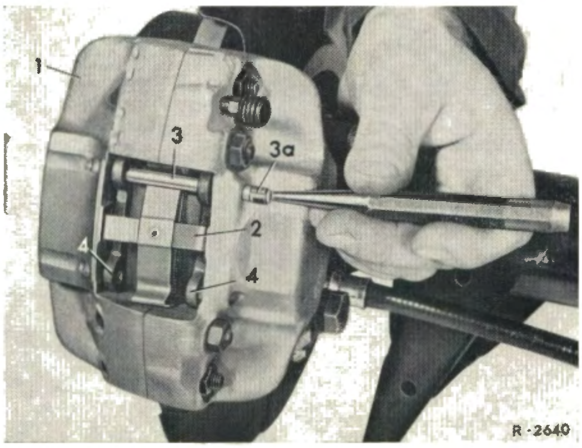


Fig. 42-10/24

1 Brake caliper
2 Crossleaf spring
3 Retaining pin
3a Clamping sleeve
4 Friction pad

12. Put the well cover plate on the brake caliper, making sure that it is firmly seated in the brake caliper.

Note: The well cover plate Part No. 000 421 02 20 can be installed subsequently; it prevents dirt from entering the brake caliper.

13. Vigorously depress the brake pedal several times until firm resistance becomes noticeable. Then check the level of the brake fluid in the reservoir and, if necessary, top up.

Note: Do not fail to depress the brake pedal, since the brakes will not operate until the friction pads rest against the brake disk.

14. After the replacement of the friction pads carefully wear in the pads in order to produce a complete wear pattern by braking the car several times from 80 to 40 km/h and

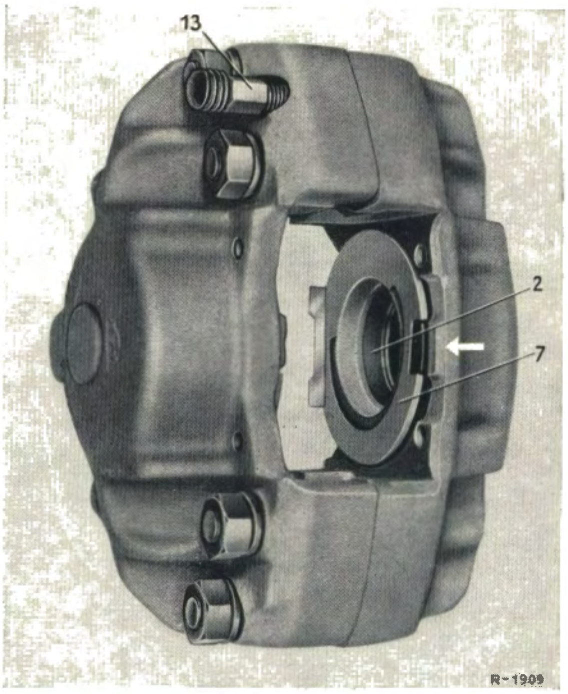


Fig. 42-10/25

2 Piston
3 Heat screening plate
13 Bleed screw

braking to a standstill with major deceleration only after the braking system has cooled down.

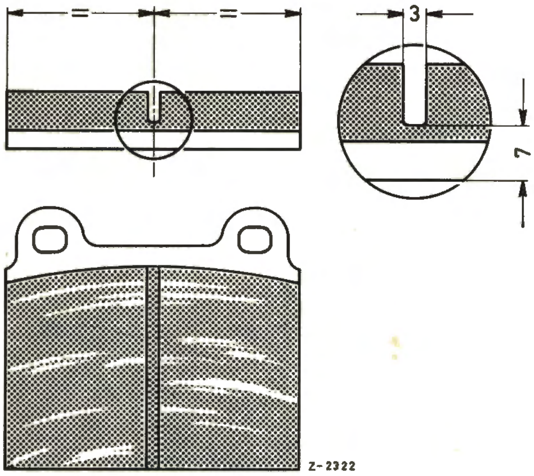


Fig. 42-10/26

Note: If initial braking with new pads is too fierce, the lining surface is liable to be charred, with the result that the car will show uneven braking action.

When new friction pads have been installed and uneven braking action results even when they have been worn in very carefully, the friction pads must be removed and re-installed according to their surface pattern.

Linings with a higher friction value have a rough streaky surface. Linings with a lower friction value have a bright smooth surface. Always install a friction pad with a smooth surface lining and a friction pad with a rough lining in each brake caliper.

Removal and Installation of Brake Disk

Job. No.
42-11

Modification: Para 4 modified and Section B added

A. Front Axle

Removal:

1. Remove the brake caliper (see Job No. 42-7).

2. Remove the front wheel hub (see Job No. 33-5).

3. Fix the front wheel hub in Fixture 136 589 05 31 and unscrew the hexagon socket screws (11) fixing the brake disk (6) to the front wheel hub (8) (Fig. 42-11/1).

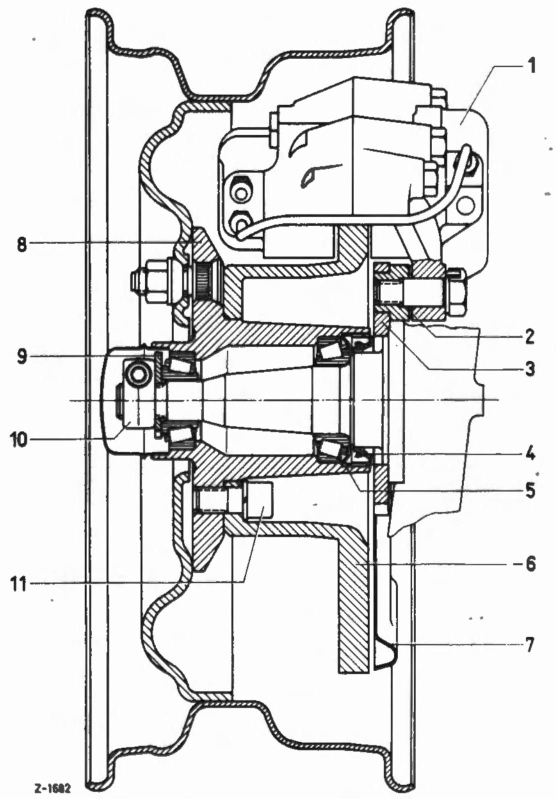


Fig. 42-11/1

1 Brake caliper
2 Shim
3 Steering knuckle bracket
4 Rubber seal
5 Disk
6 Brake disk
7 Cover plate
8 Front wheel hub
9 Washer
10 Clamping nut
11 Hexagon socket screw

Note: If the brake disk is to be used again mark the alignment between brake disk and front wheel hub before removing the brake disk.

4. Check the brake disk for scores and replace if scoring is excessive (Figs. 42-11/2 and 3).

Note: Since the brake disk is not protected against the influence of dust and dirt, scores are liable to occur after short runs of a car. Such concentric scores have no negative influence on braking action. The brake disk need only be replaced if the scoring is excessive i. e. if the scores have a depth of approx. 0.5 mm (Fig. 42-11/2).

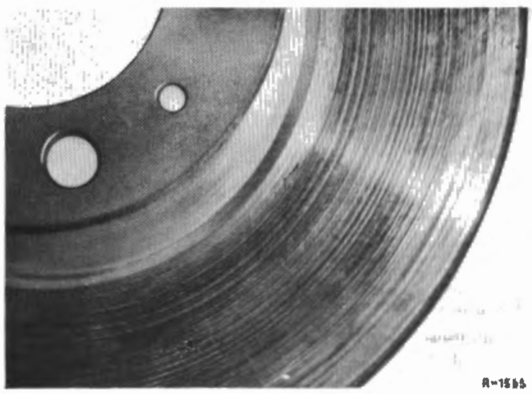


Fig. 42-11/2

The 2nd version brake disk for the Girling disk brake and the brake disk for the Dunlop disk brake on the front axle are identical (see Job No. 42-0).

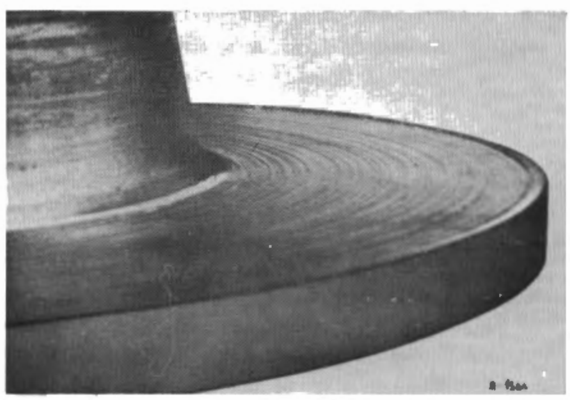


Fig. 42-11/3

On cars with mid-centering, the brake disk (2) has five milled points because of the spherical collar screw (5a). In addition it is heavily chamfered at the recess for the front wheel hub (Fig. 42-11/4).

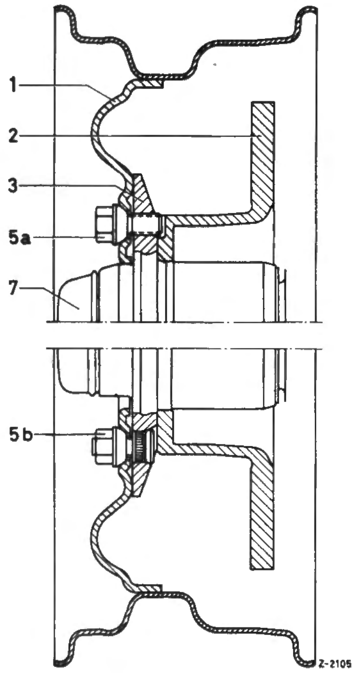


Fig. 42-11/4

1 Disk wheel
2 Brake disk
3 Front wheel hub
5a Spherical collar screw
5b Wheel fixing bolt with spherical collar nut
7 Hub cap

Installation:

5. Attach ~~the~~ brake disk (6) to the front wheel hub (8) paying attention to any previous markings. Install the hexagon socket screws (11) with new lock washers and tighten with the prescribed torque (see Job No. 42-0, Fig 42-19/1).

Note: Before attaching the brake disk, thoroughly remove any rust that may have accumulated on the brake disk flange or the front wheel hub. Make sure that there is no burr on the recess of the brake disk.

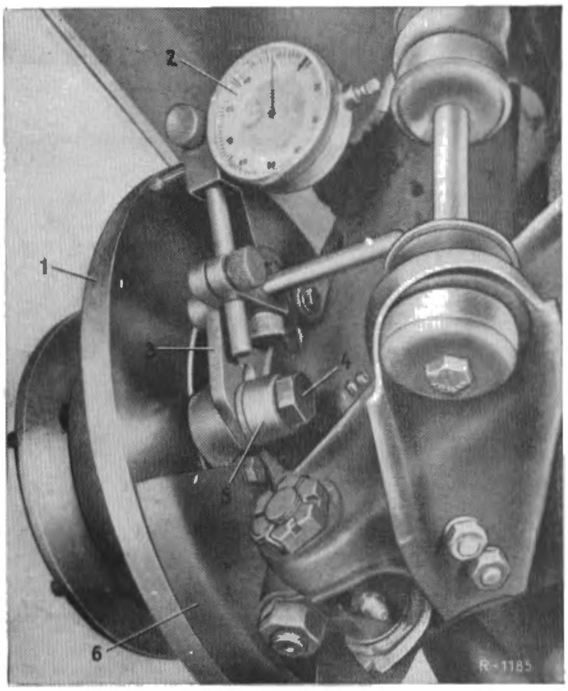


Fig. 42-11/5

1 Brake disk
2 Dial gage
3 Dial gage holder
4 Hexagon fitting screw
5 Distance sleeve
6 Cover plate

6. Install the front wheel hub (see Job No. 33-5).

7. Measure the run-out of the brake disk on the outer diameter (Fig. 42-11/5).

Note: If the run-out is excessive, reseat the brake disk on the front wheel hub.

8. Install the brake caliper (see Job No. 42-7).

9. Bleed the brake system and check for leaks.

B. Rear Axle

Removal:

1. Remove the brake caliper (see Job No. 42-7).

2. Unscrew the hexagon socket screws with which the wheel fixing disk (40) and the brake disk (19) are attached to the rear axle shaft (42) (Fig. 42-11/6).

Note: Before removing the wheel fixing disk and the brake disk, mark their relative position to the rear axle shaft.

3. Remove the wheel fixing disk and the brake disk.

4. Check the brake disk for scores and replace if scoring is excessive (see section A).

Installation:

5. Attach the brake disk and the wheel fixing disk to the rear axle shaft paying attention to previous markings.

Note: Before attaching the brake disk and the wheel fixing disk remove any rust that may have accumulated on the flange of the rear axle shaft, the wheel fixing disk, and the brake disk. Thoroughly clean the seat of the rear axle shaft making sure that the recess of the brake disk and the wheel fixing disk is free from burrs.
Always use new lock washers when installing the hexagon socket screws and tighten them with the prescribed torque (see Job No. 42-0).

6. Measure the run-out of the brake disk on the outer diameter (Fig. 42-11/6 and Job No. 42-0).

Note: If the run-out is excessive reseat the brake disk on the rear axle shaft. It is often advisable to check the flange of the rear axle shaft for run-out since very often a distorted rear axle shaft is responsible for excessive run-out of the brake disk on the rear axle. The run-out of the rear axle shaft can only be measured when the shaft has been removed from the vehicle (see Job Nos. 35-0 and 35-3).

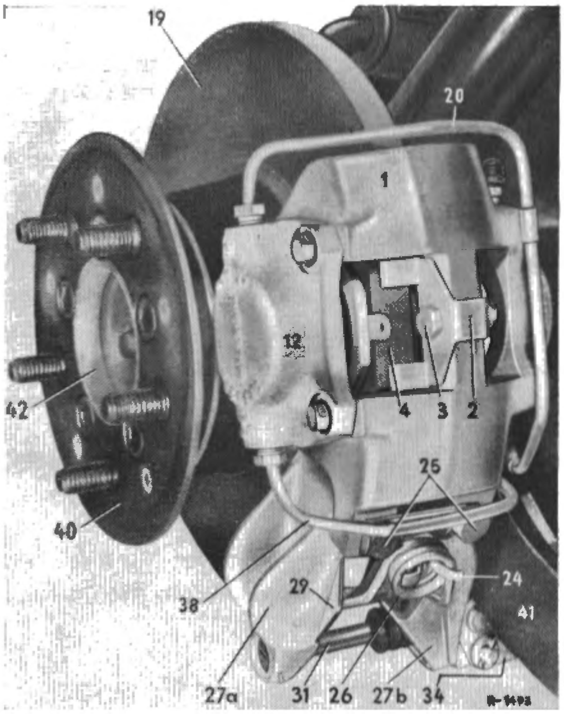


Fig. 42-11/6

1 Brake caliper
2 Stirrup
3 Hexagon screw with hexagon nut and serrated lock washer
4 Friction pad with fitting plate (service brake)
12 Pressure cylinder
19 Brake disk
20 Connecting line with pipe clip
24 Locking plate
25 Swing bolt
26 Leg spring
27a Outer lining carrier
27b Inner lining carrier
29 Friction pad with fitting plate (hand brake)
31 Adjustment screw
34 Tension lever
38 Brake line
40 Wheel fixing disk
41 Brake support lever
42 Rear axle shaft

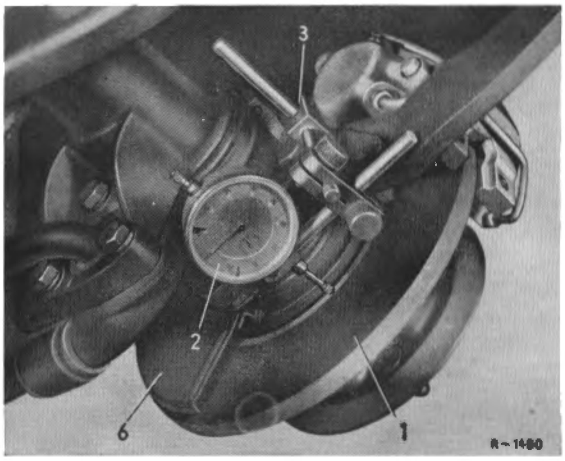


Fig. 42-11/7

1 Brake disk
2 Dial gage
3 Dial gage holder
6 Cover plate

7. Install the brake caliper (see Job No. 42-7).

8. Bleed the brake system and check for leaks.

Job No.
42-11a

Cleaning of Brake Disk

Brake disks which have been in use for a considerable period of time to acquire a coating in the braking areas which consists mostly of abrasive particles of the friction pads. Before friction pads are replaced, and when complaints are received about uneven braking action of the disk brake, these abrasive particles which accumulate in the pores of the brake disk should be removed. The special cleaning pads shown in Fig. 42-11a/1 will clean the brake disk effectively in a very short time. The cleaning pads are installed in the brake caliper in place of the friction pads. The front wheel is driven by the finish balancer produced by Messrs. Hoffmann, and the brake pedal is depressed with moderate pressure; the abrasive particles on the brake disk are removed by the abrasive cloth (grain 80) with which the cleaning pads are covered. Cleaning should only be discontinued when the dark coating has been completely removed.

The brake disks on the rear axle on Model 300 SE must not be cleaned in this way, since the one-side drive would damage the differential.

The cleaning pads, two each for the three brake caliper Makes Teves, Girling, and Dunlop, must be made in the shop according to the instructions given below in Fig. 42-11a/1.

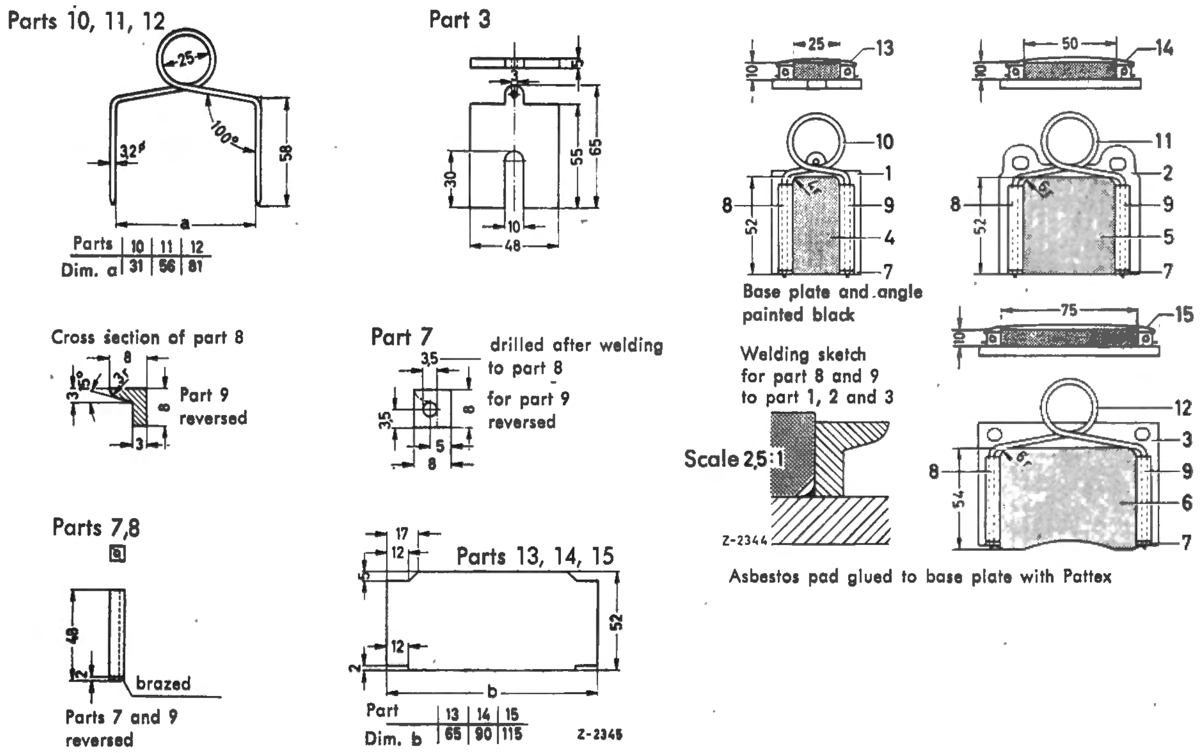


Fig. 42-11a/1

1	Base plate	St 37.2
2	Base plate	made from an old Make Teves pad
3	Base plate	made from an old Make Girling pad
4, 5, 6	Asbestos pad	
7	Center hole plate	St 37.2
8	Angle, left	St 37.2
9	Angle, right	St 37.2
10	Wire stirrup of spring steel	3.20 DIN 2076, full length 240
11	Wire stirrup of spring steel	3.20 DIN 2076, full length 260
12	Wire stirrup of spring steel	3.20 DIN 2076, full length 285
13, 14, 15	Abrasive cloth	Grain 80

Replacement of Piston Seals in Brake Caliper

Job. No.
42-12

Modification: 2nd and 3rd Versions added

Make Girling

The two halves of the brake caliper must not be disturbed since the hexagon screws have been tightened by the manufacturers with a specific tightening torque.

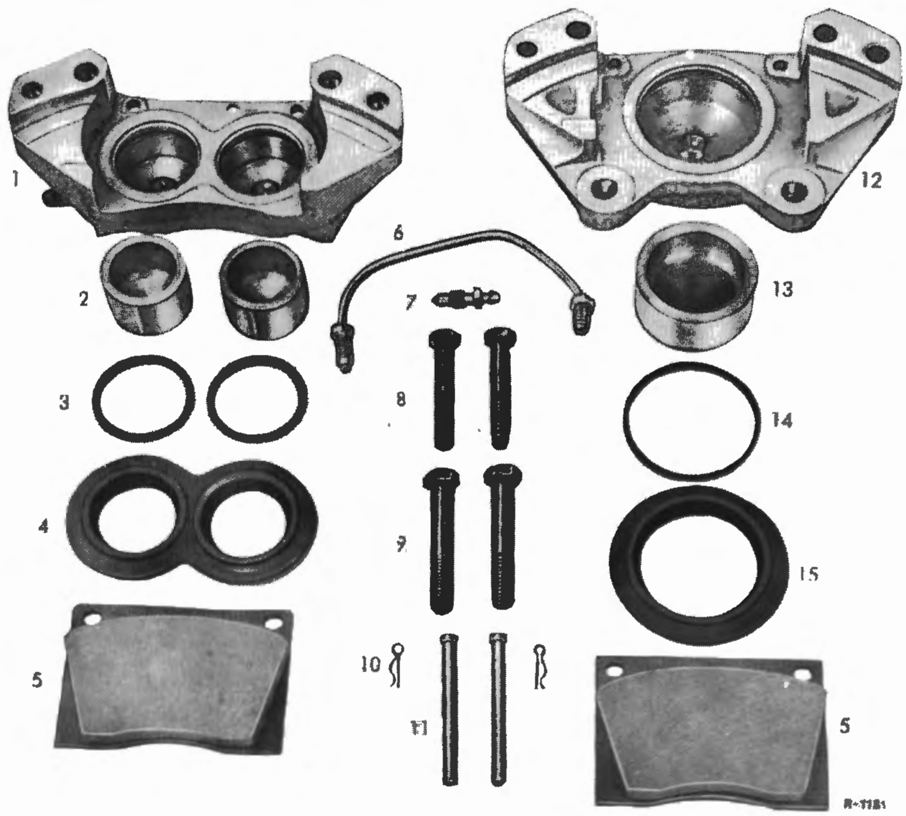


Fig. 42-12/1

1st and 2nd versions

1 Outer caliper half
2 Piston
3 Piston seal
4 Dust cap
5 Friction pad
6 Connecting line
7 Bleed screw
8 Hexagon screw
9 Hexagon screw
10 Spring clip
11 Retaining pin
12 Inner caliper half
13 Piston
14 Piston seal
15 Dust cap

Removal:

1. Remove the brake caliper (see Job No. 42-7).

2. Remove the friction pads (5). To do this, remove the spring clips (10) from the retaining pins (11) and pull out the retaining pins and friction pads (Fig. 42-12/1). See also Job No. 42-10.

Note: On the 2nd and 3rd version of the brake caliper, heat screening plates have been installed between the pistons and the friction pads.

3. On the 1st and 2nd versions disconnect the connecting line. Insert a piece of wood (3) approx. 20 mm thick in the caliper gap (1) and force the piston (5) out of the caliper with compressed air (approx. 0.5 atm.). Then remove the piece of wood and the piston (Fig. 42-12/3).

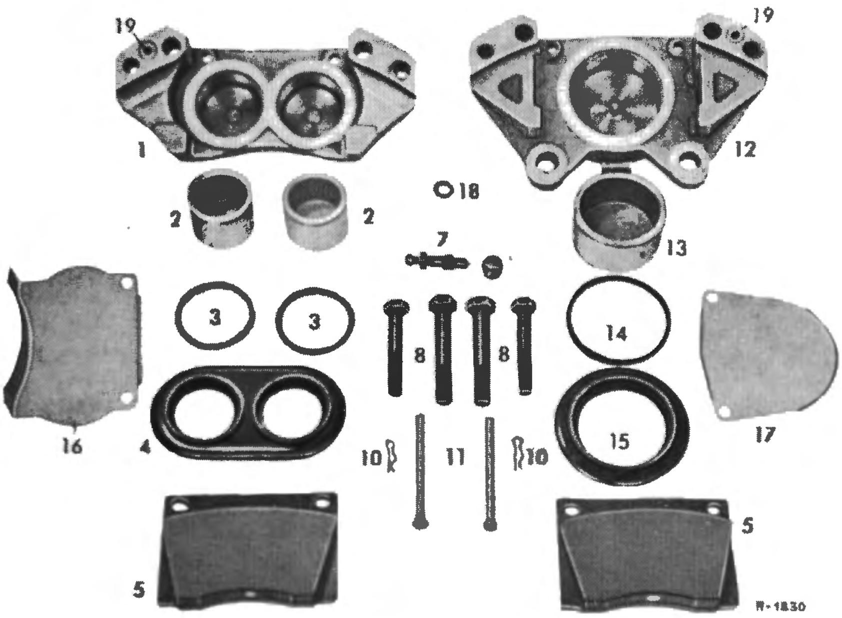


Fig. 42-12/2

3rd version

1 Outer caliper half
2 Piston
3 Piston seal
4 Dust cap
5 Friction pad
7 Bleed screw
8 Hexagon screw
10 Spring clip
11 Retaining pin
12 Inner caliper half
13 Piston
14 Piston seal
15 Dust cap
16 Heat screening plate
17 Heat screening plate
18 Rubber sealing ring
19 Connecting passage in caliper halves

On the 3rd version without connecting line first hold the inner piston in a clamp and press out the two outer pistons by means of compressed air. Then remove the clamp, shut off the pressure canal in the outer caliper half, and force out the inner piston.

Note: The piece of wood is intended to prevent damage to the pistons when they are forced out.

4. Remove the dust caps.

5. Take the piston seals (3) out of the cylinder bore groove (Fig. 42-12/4).

Note: The old piston seal should only be prized out of the annular groove with a sharp tool if the seal is to be replaced.

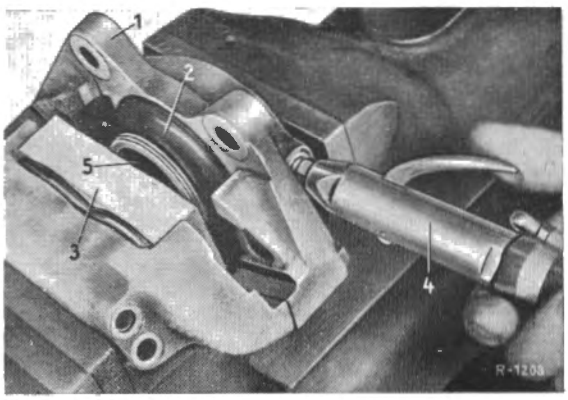


Fig. 42-12/3

1 Brake caliper
2 Dust cap
3 Piece of wood
4 Compressed air
5 Piston

6. Clean all parts thoroughly with methylated spirits or brake fluid.

Modification: Section B revised and supplemented. Rear wheel brake caliper added.

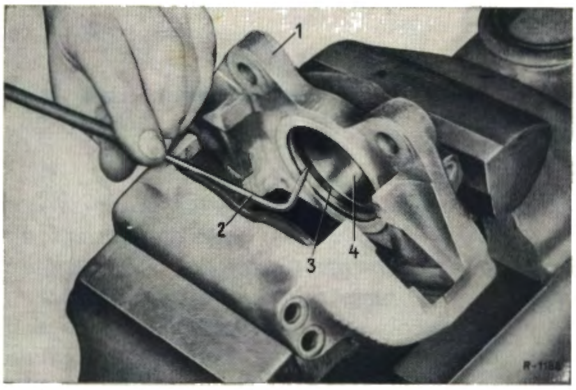


Fig. 42-12/4

1 Brake caliper
2 Scriber
3 Piston seal
4 Cylinder bore

7. Check the cylinder bores in the caliper for signs of wear. If the bores are scored or badly rusted or if the pistons are scored or rusted the complete caliper assembly must be replaced.

Note: Narrow faint rust rings in the caliper or on the pistons can be removed with abrasive cloth.

Installation:

8. Lightly rub new piston seals with ATE Brake Paste and install in the grooves of the cylinder bores.

9. Install new dust caps in the grooves of the cylinder bores and lightly rub the cylinder bores with ATE Brake Paste.

Note: Extreme care is necessary when the dust caps are inserted in the groove of the cylinder bore. If the dust cap is not properly seated in the annular groove of the cylinder bore the piston will have to be forced out again since the protecting lip of the dust cap can only be installed in the annular groove of the cylinder bore when the piston is removed.

10. Before installing the pistons, lightly coat the inside of the dust caps with castor oil to prevent corrosion.

11. Install the pistons in the bores of the caliper taking care to ensure that the dust caps are properly seated in the annular groove of the pistons.

12. On the 1st and 2nd versions connect the connecting line.

13. On the 2nd and 3rd versions install the heat screening plates. Dented plates must be reconditioned. Then install the friction pads and secure them in their position.

14. Install the brake caliper (see Job No. 42-7).

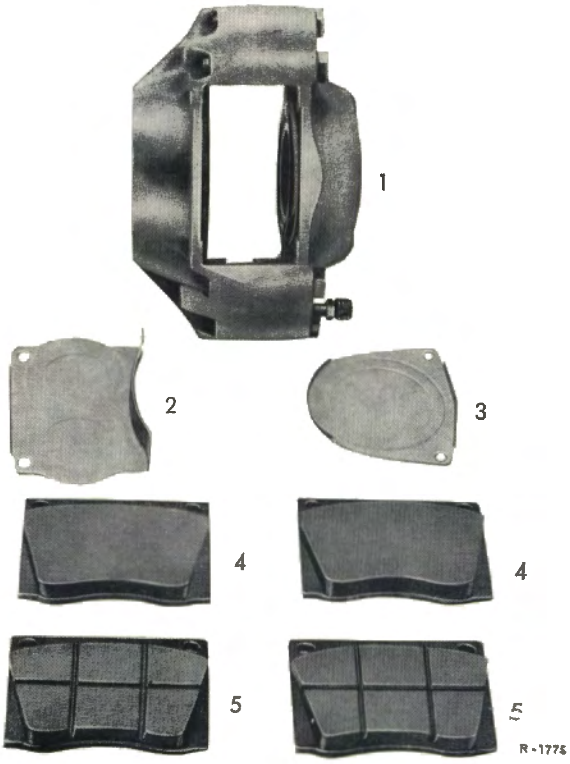


Fig. 42-12/5

1 Brake caliper
2 Outer heat screening plate
3 Inner heat screening plate
4 Friction pad Part No. 000 421 01 08
5 Grooved friction pad Part No. 000 421 03 08

B. Make Teves

Brake Caliper for Front Wheel Brake

The two halves of the brake caliper must not be disturbed, since the fastening screws have been tightened by the manufacturers with a specific tightening torque.

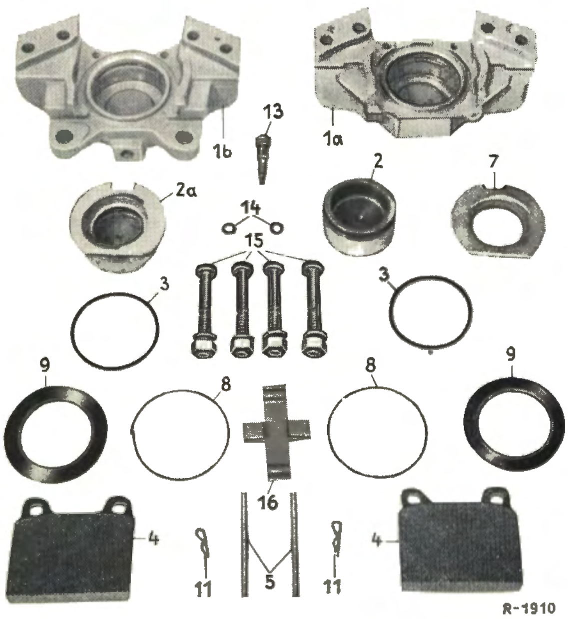


Fig. 42-12/6

1a Outer caliper half
1b Inner caliper half
2 Piston
2a Piston with heat screening plate
3 Piston seal
4 Friction pad
5 Lock pin
7 Heat screening plate
8 Clamp ring
9 Protective cap
11 Locking clip
13 Bleed screw
14 Rubber seal
15 Cylinder screw
16 Cross leaf spring

Removal:

1. Remove the brake calipers (see Job No. 42-7).

Note: Before removal the brake caliper must have cooled down to normal temperature.

2. Remove the friction pads (4). Take the locking clips (11) from the lock pins (5), push the lock pin out of the brake caliper and remove the cross leaf spring (16) and the friction pads (Fig. 42-12/7).

3. Hold the piston (2) in the brake caliper with the piston resetting tongs (18). Then press out the opposite piston by means of compressed air (approx. 0.5 atm.) (Fig. 42-12/8).

Note: To prevent damage to the piston glue a 5 mm thick piece of rubber to the piston resetting tongs.

4. When a piston is rusted in the brake caliper it cannot be forced out with compressed air since extreme pressure would be required to free a jammed piston. Remove the two heat screening plates from the piston and fix the freely moving piston in its position in the brake caliper (1) by means of the holding fixture (23). Attach the brake caliper to the brake line of the car by means of a brake hose. Bleed the brake caliper and free and force out the jammed piston by depressing the brake pedal (Fig. 42-12/7).

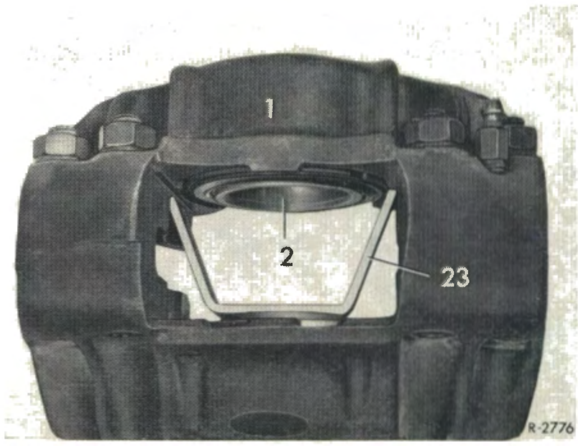


Fig. 42-12/7

1 Brake caliper
2 Piston
23 Holding fixture

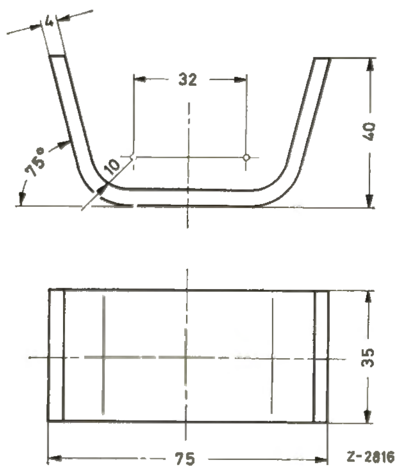


Fig. 42-12/8

Note: The holding fixture should be made in the shop in accordance with the measurements shown in Fig. 42-12/8.

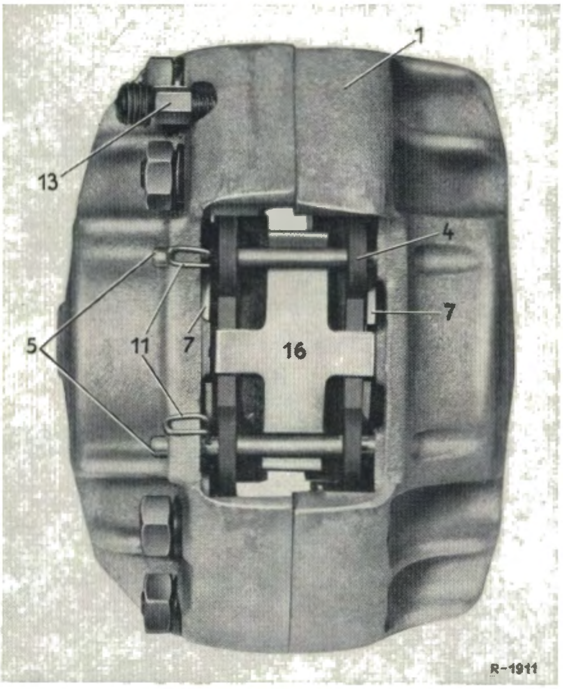


Fig. 42-12/9

1 Brake caliper
4 Friction pad
5 Lock pin
7 Heat screening plate
11 Locking clip
13 Bleed screw
16 Cross leaf spring

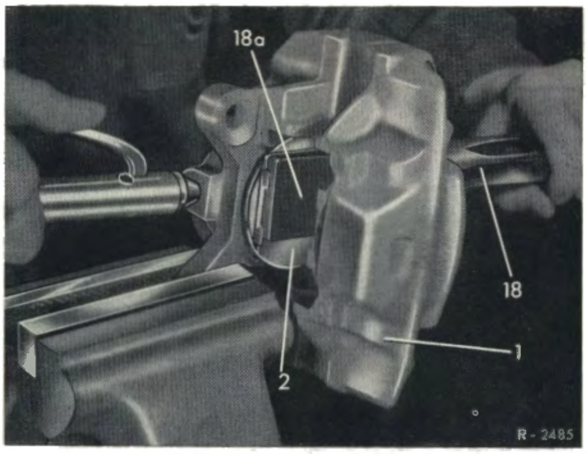


Fig. 42-12/10

1 Brake caliper
2 Piston with heat screening plate
18 Piston resetting tongs
18a Rubber plate on resetting tongs

5. Install the tensioning fixture (21) in the brake caliper in such a way that the rubber plate seals the bore. Then press out the second piston from the brake caliper (Fig. 42-12/11).

6. Remove the clamp rings (8) for the dust caps (9) and remove the dust caps from the pistons (2) (Fig. 42-12/13).

Note: Recent Teves brake calipers have been provided with a modified piston and with an improved seal consisting of a modified dust cap and an incorporated closed clamp ring.

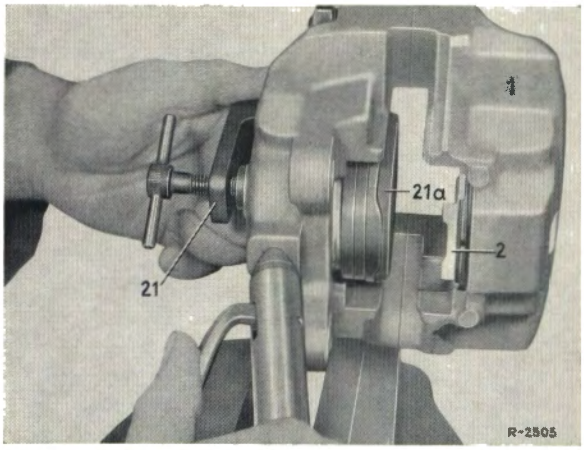


Fig. 42-12/11

1 Brake caliper
2 Piston with heat screening plate
21 Tensioning fixture
21a Rubber plate

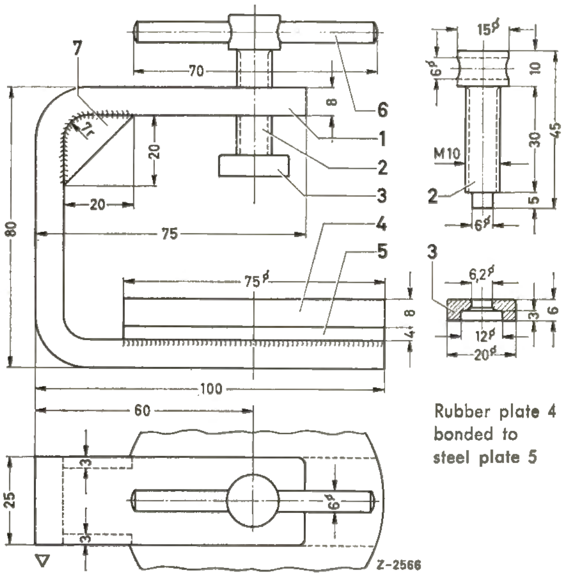


Fig. 42-12/12

Note: The tensioning fixture should be made in the shop in accordance with the dimensions given in Fig. 42-12/12.

7. Take the piston seals (3) out of the cylinder bore grooves (Fig. 42-12/13).

8. Check the cylinder bores in the caliper for signs of wear. If the bores are scored or rusted, the complete caliper assembly must be replaced.

Note: Narrow, faint rust rings in the cylinder can be removed with abrasive cloth.

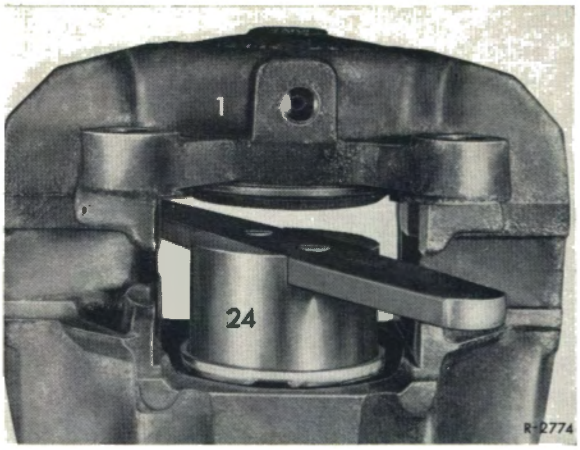


Fig. 42-12/14

1 Brake caliper 24 Tolerance plug gage

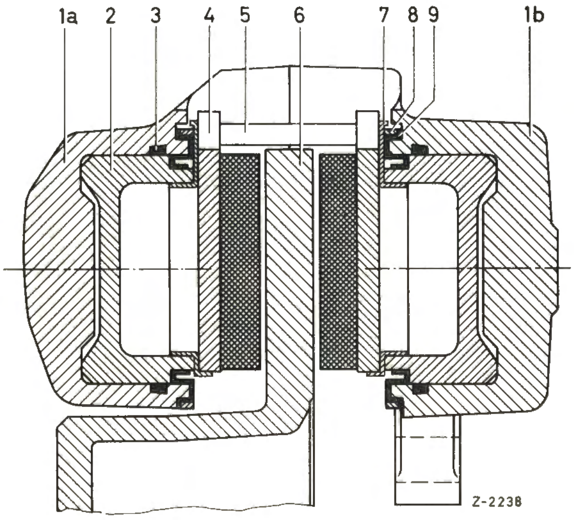


Fig. 42-12/13

1a Outer brake caliper half
1b Inner brake caliper half
2 Piston
3 Piston seal
4 Friction pad
5 Lock pin
6 Heat screening plate
8 Clamp ring
9 Dust cap

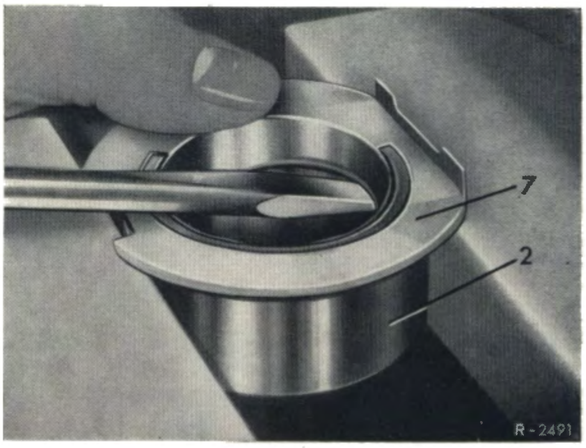


Fig. 42-12/15

2 Piston 7 Heat screening plate

Heavy rust in front of the piston seal can be removed with fine-grain emery paper (grain no. 380 to 500).

The piston must not be cleaned with abrasive or emery cloth since that would damage the chromium-plated surface of the piston. Any accumulations on the piston may be removed with a soft brass wire brush or a rough cleaning rag. If the chrome surface is damaged the piston must be replaced.

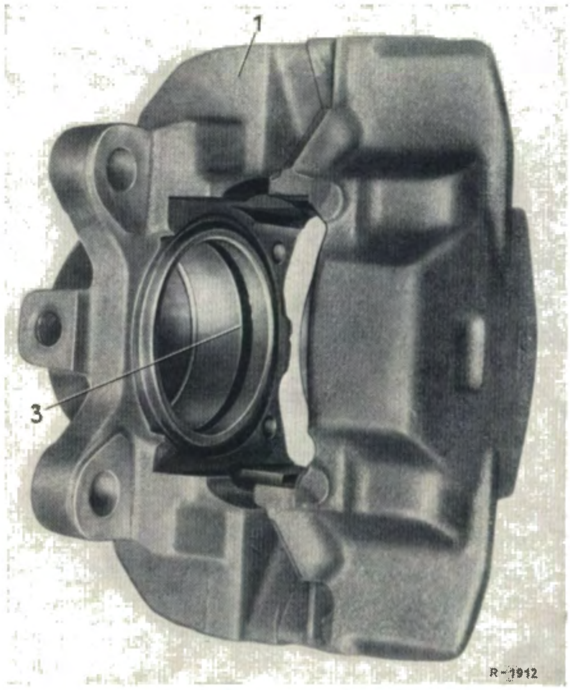


Fig. 42-12/16

1 Brake caliper 3 Piston seal

9. Check the heat screening plates (7) on the piston (2). Replace bent screening plates. To remove the plates prise them off the piston with a screwdriver (Fig. 42-12/12).

10. Check the piston bore in the brake caliper with Tolerance Plug Gage 111 589 15 21 00. If the plug gage can be inserted in the bore, the brake caliper must be replaced (Fig. 42-16/14).

Installation:

11. Lightly rub new pistons with ATE Brake Paste and install in the grooves of the cylinder bores.

12. Insert the piston (2) in the bores of the brake caliper. Then check the position of the piston by means of Piston Gage 001 589 30 21 00 (19) in the brake caliper and, if necessary, turn the piston in the correct position by Piston Turning Tool 000 589 36 37 00 (20) (Figs. 42-12/17 to 18).

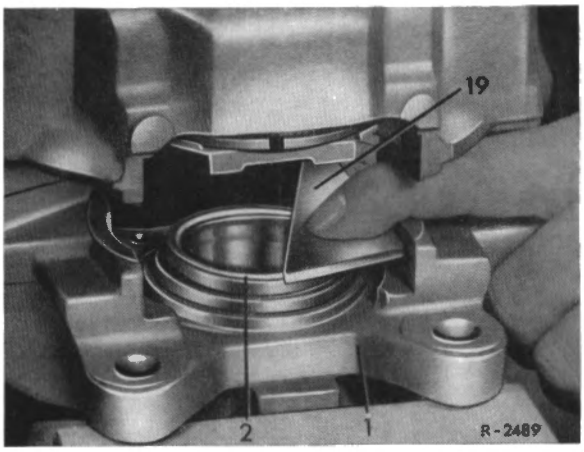


Fig. 42-12/17

1 Brake caliper
2 Piston
19 Piston Gage 001 589 30 21 00

Note: The piston must be installed in such a way that when the brake caliper is installed the lug on the piston points downward. The lug results in a one-sided contact of the friction pads which reduces the tendency to squeak.

13. Lightly wet the inside of new dust caps with castor oil "Wakefield thick" and put the caps on the pistons and the brake caliper. Then fasten the dust cap to the housing of the brake caliper by means of the clamp ring (8) (Fig. 42-12/17).

Note: Please note that 1st version pistons Part No. 000 421 32 83 must only be installed together with the repair set (sealing components) Part No. 000 586 54 88, and the 2nd version pistons Part No. 000 421 35 83 only with repair set 000 586 13 88.

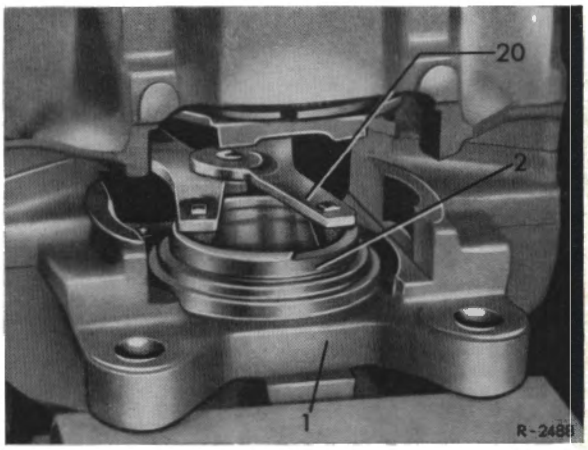


Fig. 42-12/18

1 Brake caliper 2 Piston 20 Piston Turning Tool 000 589 36 37 00

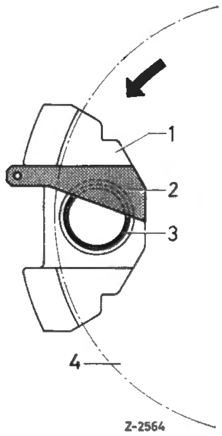


Fig. 42-12/19

1 Brake caliper
2 Piston Gage 001 589 30 21 00
3 Piston
4 Brake disk

14. Insert the heat screening plate (7) in the piston in such a way that the recess in the plate fits accurately into the lug of the piston and that the contact surface for the friction pad points toward the fixing eyes. Now insert the fixture (17) in the brake caliper and press the heat screening plate into the piston (Figs. 42-12/20 to 22).

Note: The piston ring surface should project over the heat screening plate by at least 0.1 mm. The heat screening plates for the inner and outer piston are different.

15. Install the friction pads in the brake caliper, install the cross leaf spring and secure the friction pads in position by means of the lock pins. Install the locking clips.

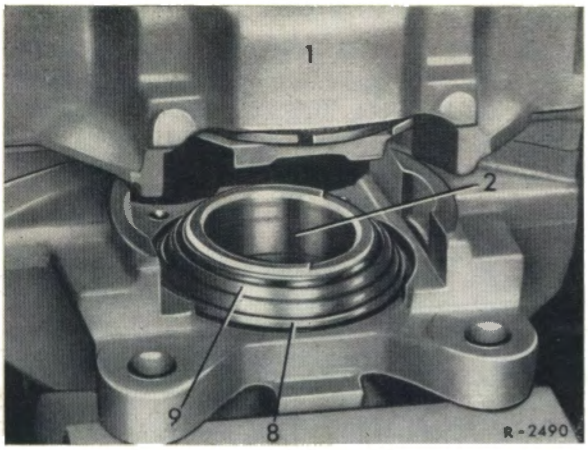


Fig. 42-12/20

1 Brake caliper
2 Piston
8 Clamp ring
9 Dust cap

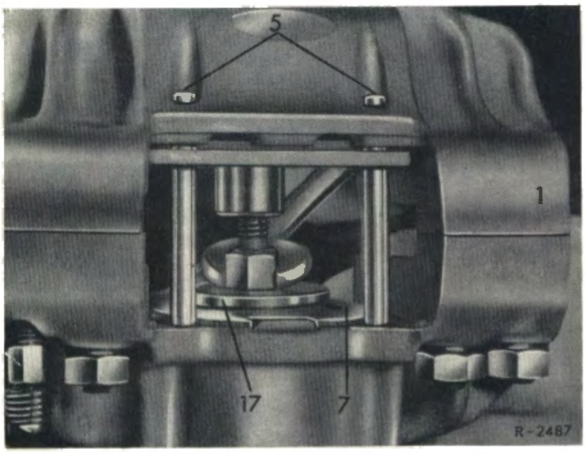


Fig. 42-12/21

1 Brake caliper
5 Retaining pins
7 Heat screening plate
17 Fixture 000 589 49 63 00

Fig. 42-12/22

2 Piston
7 Heat screening plate
13 Bleed screw

Note: The locking clips are different; they must be inserted in the lock pins in such a way that the rounded leg on the upper lock pin points upward and the lower lock pin points downward.

16. Install the brake caliper, bleed the brake system and then check the brake caliper for leaks.

b) Brake Caliper for Rear Wheel Brake (Model 300 SE)

The two halves of the brake caliper must not be disturbed since the fastening screws have been tightened by the manufacturers with a specific tightening torque.

Disassembly:

1. Remove the brake calipers (see Job No. 42-7).

2. Remove the friction pads. Take out the locking clips (3), push out the lock pin (5), and remove the crossleaf spring (2), the screening plate in front of the outer piston and the friction pads (Fig. 42-12/23).

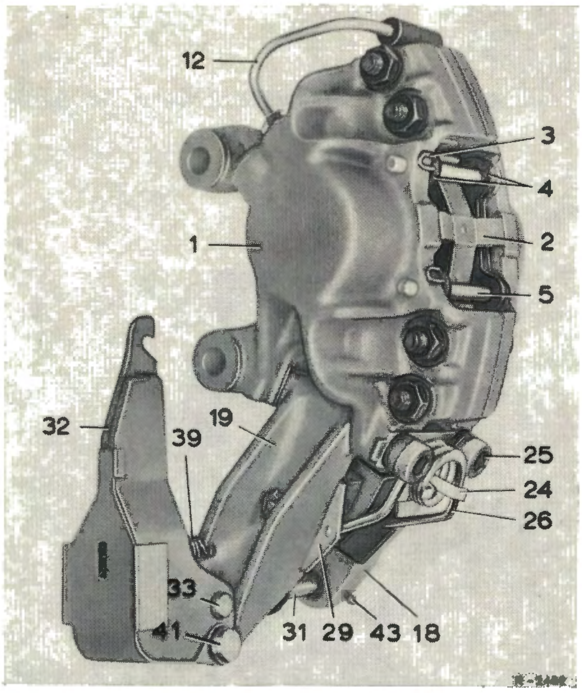


Fig. 42-12/23

1 Brake caliper	25 Swing bolt
2 Crossleaf spring	26 Leg spring
3 Locking clip	29 Friction pad (parking brake)
4 Friction pad (service brake)	31 Adjusting screw
5 Lock pin	32 Tension lever
12 Connecting line	33 Crosshead
18 Inner lining carrier	39 Return spring
19 Outer lining carrier	41 Collar bolt
24 Retaining plate for leg spring	43 Cotter pin

3. Detach the connecting line (12) from the brake caliper.

4. Remove the clamp ring (1) and the dust cap (2) from the pressure cylinder (5) and the piston (4) (Fig. 42-12/24).

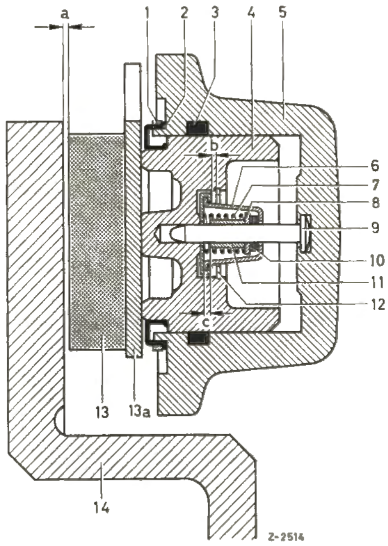


Fig. 42-12/24

1 Clamp ring	8 Spacer washer
2 Dust cap	9 Guide pin
3 Piston seal	10 Clamp rings
4 Piston	11 Spacer sleeve
5 Brake caliper pressure cylinder	12 Piston stop ring
6 Stop cap	13 Friction pad
7 Pressure spring	13a Back plate
	14 Brake disk

5. Fit the piston resetting tongs (18) in the brake caliper in such a way that the rubber plate (18a) points inward and press out the opposite piston (Fig. 42-12/26).

Note: The rubber plate prevents damage to the piston.

The required pressure is about 8 atm. since the piston does not move easily on the guide pin.

6. Again fit the piston resetting tongs with the rubber plate pointing inward and press out the other piston.

7. Remove the piston seals (3) from the grooves in the cylinder bore (Fig. 42-12/24).

8. Check the cylinder bores in the brake caliper for signs of wear. If the bores are scored or rusted, replace the brake caliper assembly.

Note: Narrow faint rust rings in the cylinder can be removed with abrasive cloth (grain no. 380-500). Rust on the piston should only be removed with a coarse cleaning rag since abrasive cloth will damage the chrome surface of the piston. If the piston surface is flaked or rusty, the piston must be replaced.

The disk wobble compensator in the piston cannot be repaired. It can only be removed from the piston to provide better access for cleaning the piston. To do this remove the circlip (12) from the piston (4) (Fig. 42-12/25).

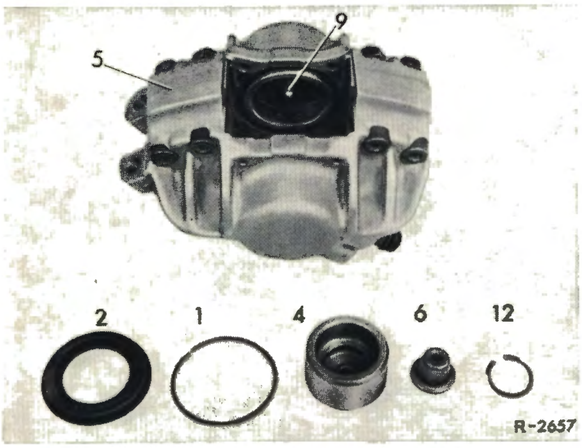


Fig. 42-12/25

1 Clamp ring
2 Dust cap
4 Piston
5 Brake caliper
6 Stop cap with disk wobble compensator
9 Guide pin
12 Circlip

9. Thoroughly clean all parts in methylated alcohol. Never use gasolin, kerosene or trichloroethylene since mineral oil and chemically related fluids will cause the sealing rings to swell which provide the seal between the two caliper halves; as a result the brake caliper will be full of leaks in no time.

Reassembly:

10. Lightly rub new piston seals with ATE Brake Cylinder Paste and install in the grooves of the cylinder bores.

11. Put the piston (4) on the guide pin (9) and push it into the pressure cylinder by exerting an even pressure on the piston with the piston resetting tongs. Take care to ensure that the piston is pressed into the cylinder in complete alignment with the cylinder walls (Fig. 42-12/14 and 42-12/26).

13. Fit the screening plate to the outer piston and install the friction pads. Install the lock pins and the locking clips.

14. Install the brake caliper, bleed the brake system, and check for leaks.

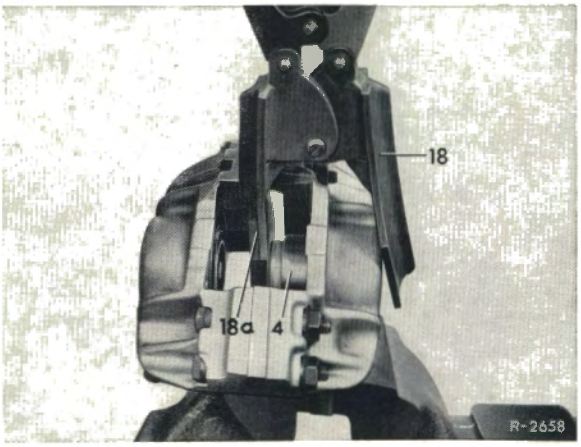


Fig. 42-12/26

4 Piston
18 Piston resetting tongs
18a Rubber plate on piston resetting tongs

Pressure Cylinder

Job No.
42-13

A. Removal and Installation of Pressure Cylinder

Removal:

1. Detach the connecting line (4) and the brake line (11) from the pressure cylinder (Fig. 42-13/1).

Note: When the inner pressure cylinder is removed it is not necessary to detach the brake line.

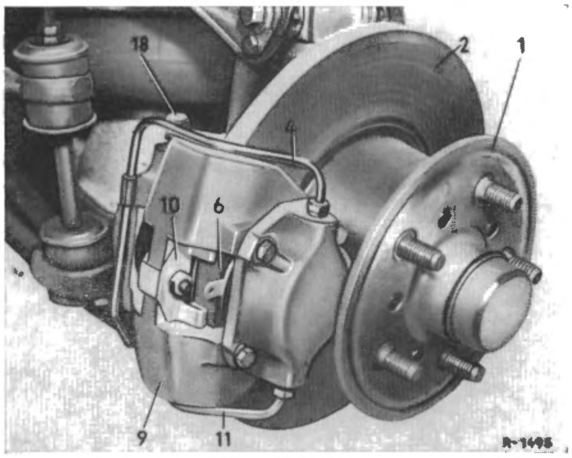


Fig. 42-13/1

1 Front wheel hub	9 Brake caliper
2 Brake disk	10 Stirrup
4 Connecting line	11 Brake line
6 Friction pad	18 Bleed screw

2. Remove the stirrup (10) and the friction pad (6) from the aperture of the brake caliper (9) (Fig. 42-13/1).

3. Unscrew the four hexagon screws and remove the pressure cylinder and the connecting line.

4. Clean the guide for the lining pressure plate in the caliper and remove any pressure marks and rust.

Installation:

5. Attach the pressure cylinder to the caliper (9) making sure that the lining pressure plate of the piston is properly seated in the guide of the caliper. Install friction pad (6) and stirrup (10) (Fig. 42-13/1).

6. Attach the connecting line (4) and the brake line (11) to the pressure cylinder (Fig. 42-13/1).

Note: The connecting line is attached to the inner cylinder by and additional pipe clip.

7. Bleed the brake system and check for leaks.

8. Depress the brake pedal hard several times to make sure that the friction pads make contact with the brake disk. Then check and if necessary top up the brake fluid reserve in the reservoir.

Note: Do not fail to depress the brake pedal several times before driving the car away because the brakes will not operate unless the friction pads make contact with the brake disk and the correct clearance is obtained.

B. Disassembly and Reassembly of Pressure Cylinder

Disassembly:

Note: The pressure cylinder can only be disassembled and reassembled by means of Assembly Fixture Part No. 000 589 29 63 00. This assembly fixture consists of the following parts: ring, assembly ram, disassembly ram and bushing.

1. Remove the pressure cylinder.

2. Take the dust cap out of the groove of the pressure cylinder. Plug one connection on the pressure cylinder. Install the pressure cylinder (1) in the bushing (2), clamp the two parts in a vise and force the piston out of the pressure cylinder with compressed air (at approx. 2 atm) (Fig. 42-13/3).

Force the piston out very carefully.

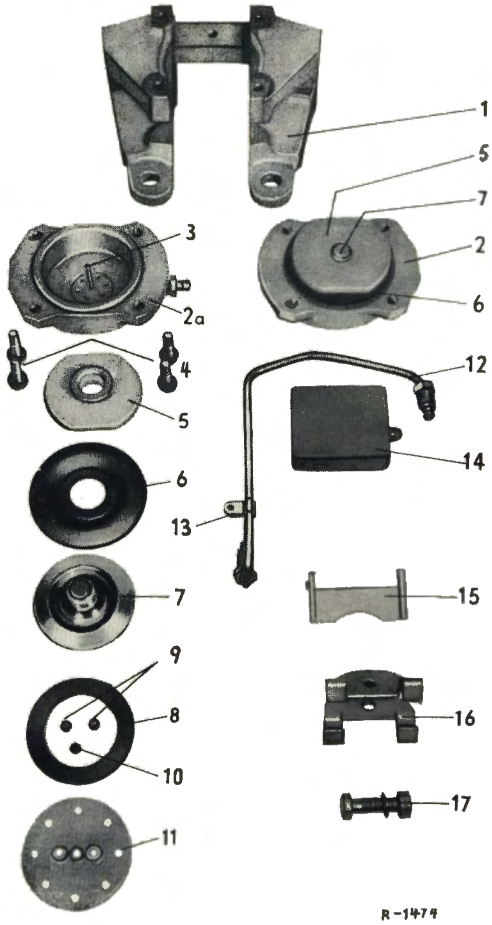


Fig. 42-13/2

1 Brake caliper
2 Pressure cylinder assembly
2a Pressure cylinder housing
3 Return pin
4 Hexagon screw with serrated lock washer
5 Lining pressure plate
6 Dust cap
7 Piston
8 Piston seal
9 Countersunk screw
10 Friction spring
11 Piston plate
12 Connecting line
13 Pipe clip
14 Friction pad
15 Retaining plate
16 Stirrup
17 Hexagon screw with hexagon nut and serrated lock washer

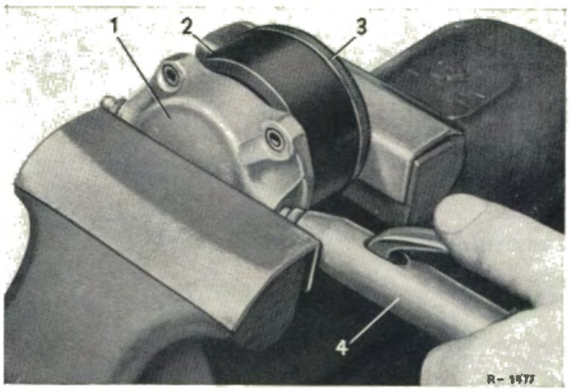


Fig. 42-13/3

1 Pressure cylinder
2 Bushing
3 Ring
4 Compressed air

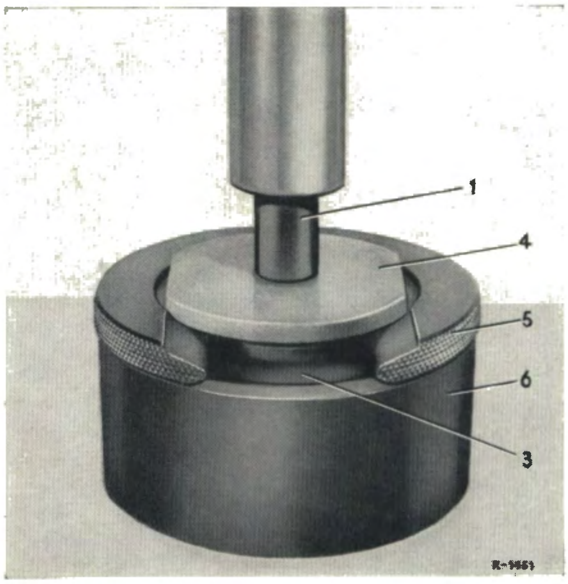


Fig. 42-13/4

1 Disassembly ram
3 Dust cap
4 Lining pressure plate
5 Ring
6 Bushing

3. Unscrew the countersunk screws (9) from the piston (7) and take out the piston plate (11), the piston seal (8), and the friction spring (10) (Fig. 42-13/2).

4. Use an arbor press to press the lining pressure plate (4) off the piston by means of the disassembly ram (1). Remove the dust cap (3) (Fig. 42-13/4).

5. Thoroughly clean all parts with alcohol or brake fluid. Make sure that the dust cap groove on the pressure cylinder is thoroughly cleaned from dirt.

Reassembly:

6. Install a new dust cap in the annular groove of the lining pressure plate.

7. Press the lining pressure plate (4) into the piston (2) by means of the reassembly ram (1) (Fig. 42-13/5).

8. Insert the friction spring (10) in the bore of the piston (7) (Fig. 42-13/2).

Fig. 42-13/5

1 Reassembly ram
2 Piston
3 Dust cap
4 Lining pressure plate
5 Ring
6 Bushing

9. Coat a new piston seal (8) with ATE Brake Paste, put it on the piston (7) and attach the piston plate (11) to the piston (Fig. 42-13/2).

Note: The outside diameter of the piston seal must be larger than the outside diameter of the piston by approx. 1 mm.

10. Put the piston (7) o the return pin (15) and press it into the pressure cylinder (2a) by exerting an even pressure on the lining pressure plate (5) (Fig. 42-13/2).

Note: Take care to ensure that the piston is always properly aligned in relation to the cylinder bore and that the piston seal is neither squeezed nor distorted.

11. Spray some anti-corrosion oil (Wakefield "viscous") or castor oil under the dust cap. Insert the dust cap in the groove of the pressure cylinder and install the pressure cylinder in the brake caliper.

ATE Power Brake T 50

Modification: Notes added to Paras 2 and 4

A. General

The 1st version ATE Power Brake T 50/24 is installed in Models 220 b and 220 SEb and as optional equipment in Model 220 b. Since the check valve in the associated master cylinder maintains a residual pressure of approx. 0.4–1.2 atm., this pressure is present in the whole hydraulic system of the power brake.

The 2nd version is ATE Power Brake T 50/24/1 which is installed together with a master cylinder with special check valve. This unit has the check valve in the hydraulic slave cylinder and the check valve in the master cylinder has an 0.7 mm diameter bore. As a result there is no residual pressure in the power brake and in the lines leading to the master cylinder. Since there is no counter-pressure on the control valve piston of the power brake, the brake can be released quickly and safely. In addition, the ATE Power Brake T 50/24/1 has a bleed screw.

ATE Power Brake T 50/26 is installed in cars which are provided with disk brakes on the front and rear axles or on the front axle only. The associated master cylinder also has a special check valve so that the hydraulic system also in this power brake is not under pressure when the brakes are in the non-applied position. The residual pressure necessary for the proper functioning of the rear wheel drum brake is maintained by a primary pressure valve installed between the distributor fitting on the master cylinder and the brake line to the rear wheel drum brake.

B. Replacing the Air Cleaner Element

The air cleaner element of the ATE power brake is located at the front of the power brake. Since its position protects it from dust, the air cleaner element does not under normal circumstances require replacing, until a mileage of 100 000 km has been reached. For this purpose remove the power brake.

A special type of power brake can be supplied for use in a very dusty country. In this type the air cleaner element is in an easily accessible position, so that it can be replaced readily as required (Figs. 42-14/1 and 14/2).

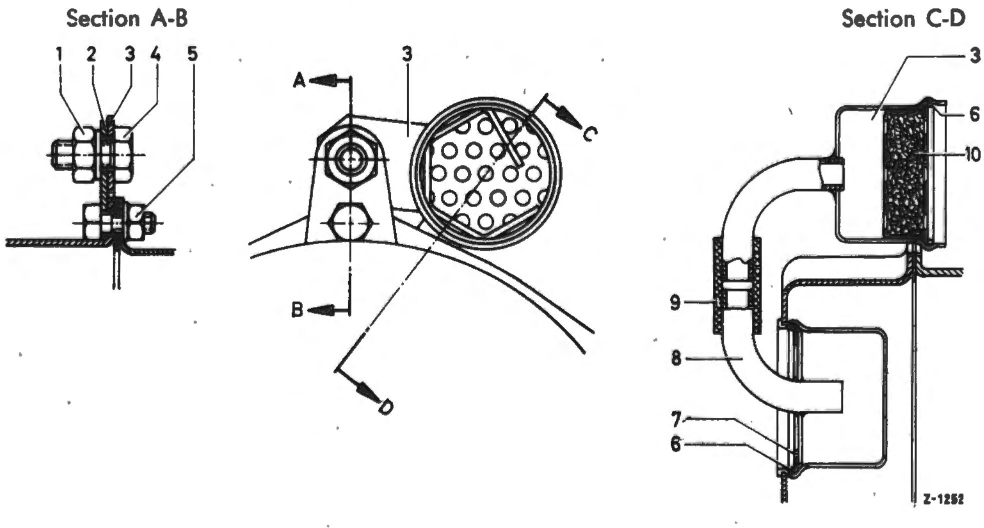


Fig. 42-14/1

1st version

1 Hexagon nut
2 Bracket
3 Air cleaner
4 Hexagon screw
5 Hexagon nut
6 Snap ring
7 Sealing ring
8 Hose connection
9 Hose
10 Air cleaner element

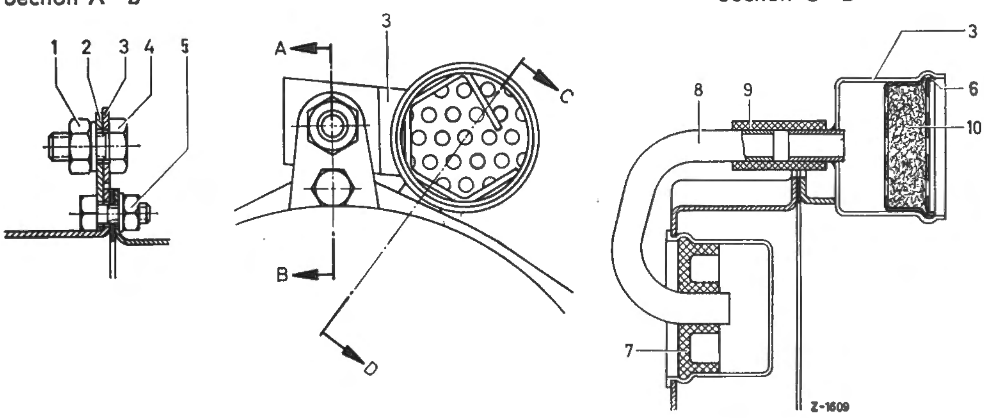


Fig. 42-14/2

2nd version

1 Hexagon nut
2 Bracket
3 Air cleaner housing
4 Hexagon screw
5 Hexagon nut
6 Snap ring
7 Plug
8 Pipe
9 Hose
10 Air cleaner element

C. Removal and Installation of ATE Power Brake

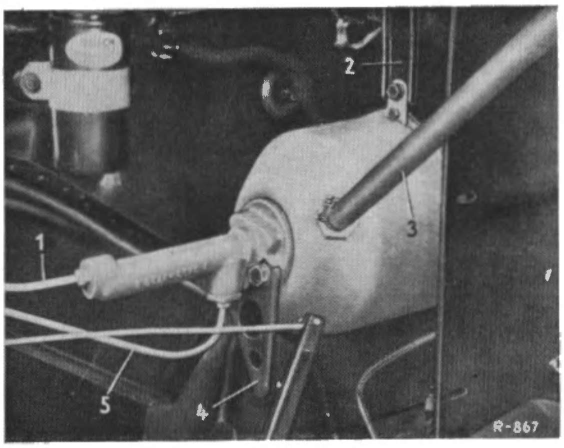


Fig. 42-14/3

ATE Power Brake T 50/24

1 Brake line (pressure supply)
2 Bracket on reinforcement plate
3 Vacuum line
4 Bracket on chassis base panel
5 Feed line

Removal:

1. Disconnect brake lines (1) and (5) and the vacuum hose (3) from the power brake (Fig. 42-14/3).
2. Unscrew the power brake at the bracket (4) on the chassis base panel and the bracket (2) at the reinforcement plate and remove (Fig. 42-14/3).

Note: As a result of installing the disk brake in Models 220 Sb and 220 SEb and the consequent changeover to power brake T 50/26, the bracket (2) on the chassis had to be moved backward since power brake T 50/26 has a longer vacuum cylinder than power brake T 50/24/1. When power brake T 50/24/1 is installed in Model 220 b, a spacer sleeve has to be added between the bracket on the power brake and the bracket (1) on the reinforcement plate (Fig. 42-14/4).

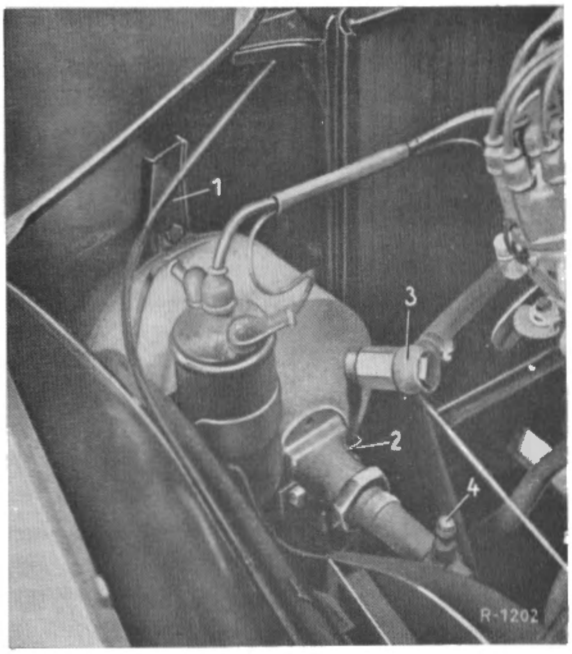


Fig. 42-14/4

ATE Power Brake T 50/26

1 Bracket on reinforcement plate
2 Bracket on chassis base panel
3 Annular fitting for vacuum connection
4 Bleed screw

Installation:

3. Attach the power brake to the brackets.

Note: When installing a new power brake make sure that it is the correct type for the master cylinder installed (see Table in Job No. 42-0).

4. Connect the brake lines and the vacuum hose to the power brake.

Note: Tighten the hollow screw for fastening the annular fitting (3) on power brake T 50/26 with a torque of 2.5–3.0 mkg (Fig. 42-14/4).

5. Bleed the brake system and check for leaks.

Note: Power Brakes T 50/24/1 and T 50/26 are provided with a bleed screw on the hydraulic slave cylinder.

Power Brake T 51

A. Removal and Installation of Power Brake

Note: The power brake is removed from the vehicle together with the tandem master cylinder.

Removal:

1. On all models with the exception of Models 190 c and 230 SL remove the battery. On Model 300 SE also remove the reservoir for the high pressure oil pump.

2. Pump the brake fluid out of the reservoir (2) of the tandem master cylinder (3) via an opened bleed screw in the front wheel and rear wheel brake circuits, making sure that both chambers of the reservoir are emptied. Then detach the brake lines from the master cylinder (Fig. 42-16/1).

Note: Close the brake lines by means of the rubber caps of the bleed screws, and the tandem master cylinder connections by means of dummy plugs.

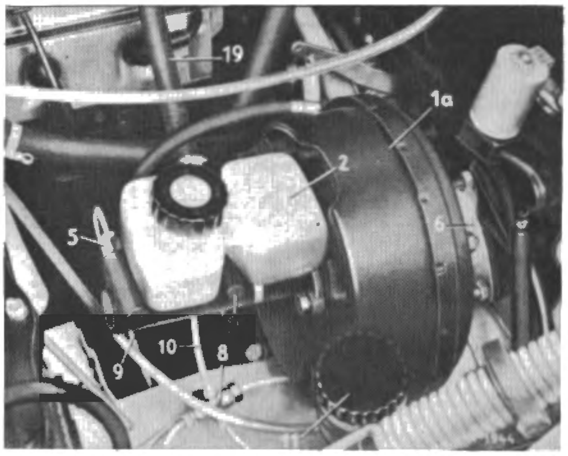


Fig. 42-16/1

Arrangement on Models 190 c and 190 Dc
(Tandem master cylinder 1st version)

1a Power brake T 51/100
2 Reservoir
3 Tandem master cylinder
5 Residual pressure valve
6 Intermediate flange
8 Distributor fitting
9 Brake line to rear wheel brake
10 Brake line to distributor fitting
11 Reservoir for supply cylinder
19 Vacuum hose

3. Detach the vacuum hose (19) from the check valve (21) of the power brake (Figs. 42-16/5 to 42-16/7).

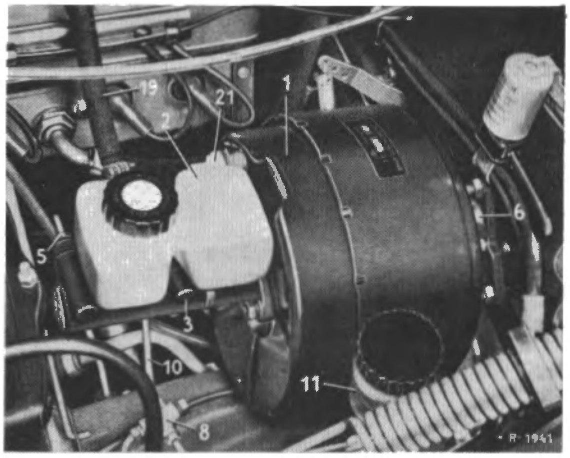


Fig. 42-16/2

Arrangement on Models 220 b, 220 Sb, 220 SEb
(Tandem master cylinder 1st version)

1 Power brake T 51/200
2 Reservoir
3 Tandem master cylinder
5 Residual pressure valve
6 Intermediate flange
8 Distributor fitting
10 Brake line to distributor fitting
11 Reservoir for supply cylinder
19 Vacuum hose
21 Check valve

4. On Model 230 SL detach the piston rod (18) of the power brake (1) from the relay lever (15) by backing out the adjusting screw (14) (Fig. 42-16/3).

5. On all other models detach the piston rod of the power brake from the brake pedal (9) by backing out the adjusting screw (2) (Fig. 42-16/6).

6. On all models with the exception of Model 230 SL remove the power brake (1) together with the intermediate flange (6). To do this, back out two hexagon nuts in the engine compartment and one hexagon nut in the passenger compartment (Fig. 42-16/5).

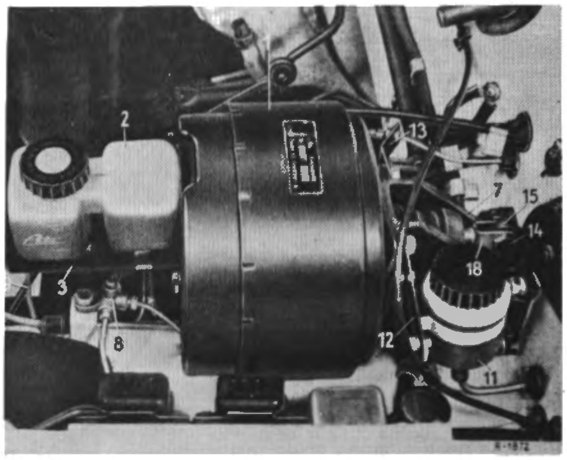


Fig. 42-16/3

Arrangement on Model 230 SL (Tandem master cylinder 1st version)

1 Power brake T 51/200
2 Reservoir
3 Tandem master cylinder
7 Bearing bracket
8 Distributor fitting
9 Brake line to rear wheel brake
11 Reservoir for supply cylinder
12 Bracket for reservoir
13 Bracket for oil pressure gage line
14 Adjusting screw with hexagon nut and lock washer
15 Relay lever
18 Piston rod of power brake

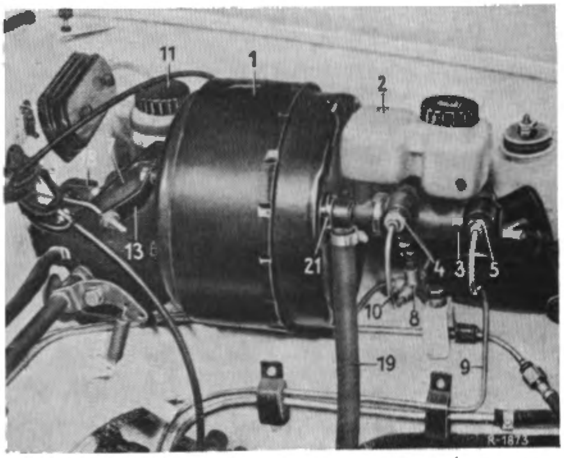


Fig. 42-16/4

Arrangement on Model 230 SL (Tandem master cylinder 1st version)

1 Power brake T 51/200
2 Reservoir
3 Tandem master cylinder
4 Special check valve
5 Residual pressure valve
7 Bearing bracket
8 Distributor fitting
9 Brake line to rear wheel brake
10 Brake line to distributor fitting
11 Reservoir for supply cylinder
13 Bracket for oil pressure gage line
18 Piston rod
19 Vacuum hose
21 Check valve

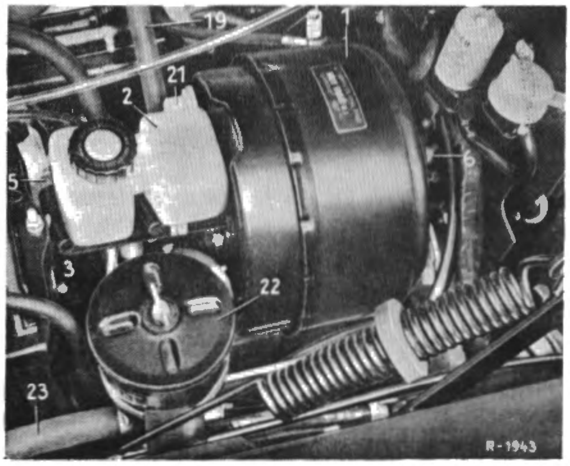


Fig. 42-16/5

Arrangement on Model 300 SE (Tandem master cylinder 1st version)

1 Power brake
2 Reservoir
3 Tandem master cylinder
5 Special check valve
6 Intermediate flange
19 Vacuum hose
21 Check valve
22 Reservoir for high pressure oil pump
23 Connecting line to high pressure oil pump

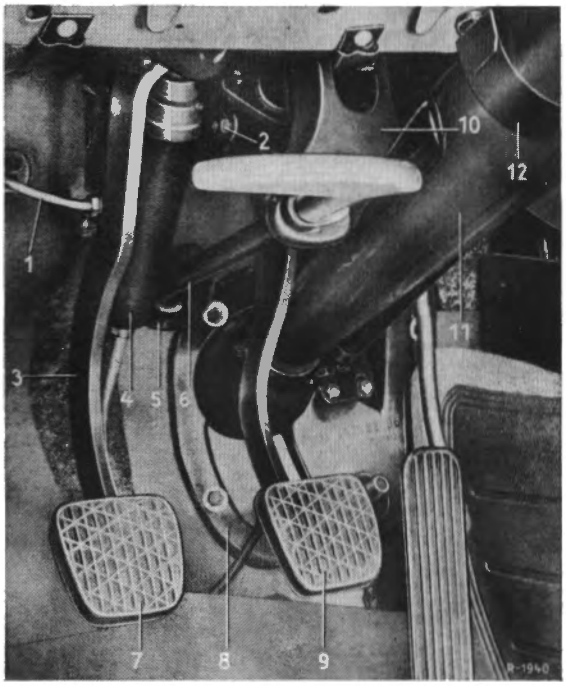


Fig. 42-16/6

1 Line from reservoir to supply cylinder
2 Adjusting screw with hexagon nut and lock washer
3 Clutch pedal
4 Supply cylinder
5 Rubber sleeve
6 Guide tube for ratchet
7 Foot plate of clutch pedal
8 Cover plate
9 Brake pedal
10 Bracket for guide tube
11 Steering column jacket
12 Tightening strap

7. On Model 230 SL detach the power brake (1) from the bearing bracket (7) and remove (Fig. 42-16/3).

Note: The control housing of the power brake has a very low impact strength. It is made of plastics and may break off if not treated carefully. On no account must the brake be dropped.

Installation:

Note: Before installing the power brake make sure that the leak port in the tandem master cylinder is not clogged.

8. On all models with the exception of Model 230 SL install the power brake (1) together with the intermediate flange (6) (Fig. 42-16/5).

9. On Model 230 SL attach the power brake (1) to the bearing bracket (7) (Fig. 42-16/3).

Note: On Model 230 SL also attach the bracket (13) for the oil pressure gage line and the bracket (12) for the reservoir of the supply cylinder to the bearing bracket (Fig. 42-16/3).

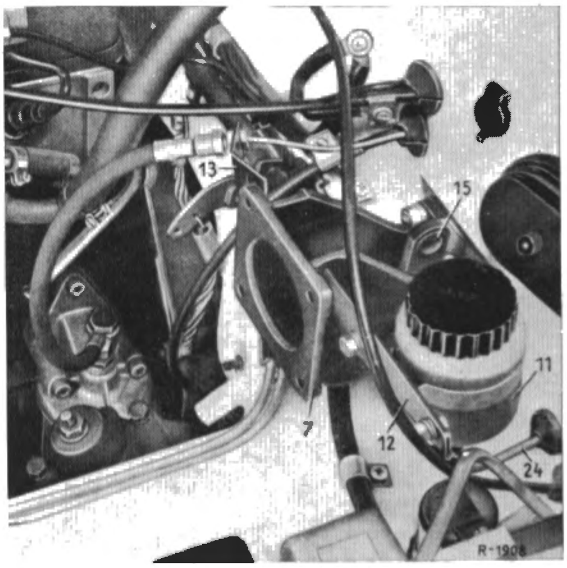


Fig. 42-16/7

Arrangement on Model 230 SL

7 Bearing bracket
11 Reservoir for supply cylinder
12 Bracket for reservoir
13 Bracket for oil pressure gage line
15 Relay lever
24 Line to supply cylinder

10. On Model 230 SL attach the piston rod (18) of the power brake (1) to the relay lever (15) by means of the adjusting screw (14) (Fig. 42-16/3).

11. On all other models attach the piston rod to the brake pedal (9) (Fig. 42-16/6).

12. Adjust the brake pedal travel (see Job No. 42-20, Section C).

13. Attach the brake lines and the vacuum hose to the tandem master cylinder and the power brake.

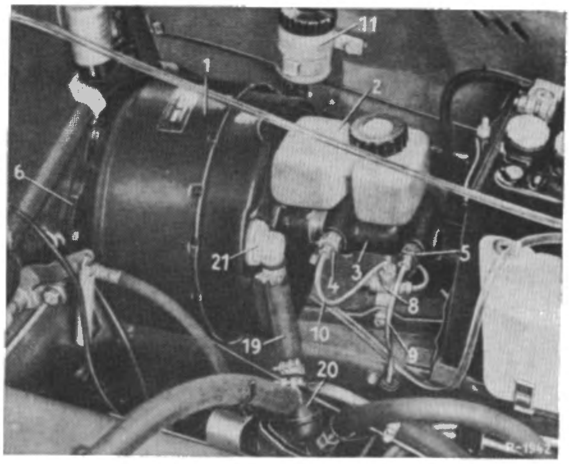


Fig. 42-16/8

Arrangement on Models 220 b, 220 Sb, 220 SEb

1 Power brake T 51/200
2 Reservoir
3 Tandem master cylinder
4 Special check valve
5 Residual pressure valve
6 Intermediate flange
8 Distributor fitting
9 Brake line to rear wheel brake
10 Brake line to distributor fitting
11 Reservoir for supply cylinder
19 Vacuum hose
20 Gasoline separator
21 Check valve

14. Bleed the brake system and check for leaks.

15. On all models with the exception of Models 190 c and 230 SL install the battery and on Model 300 SE also install the reservoir for the high pressure oil pump.

B. Replacement of Filter in Power Brake

Removal:

1. Remove the power brake and the tandem master cylinder (see Section A).

2. Remove the protective cap (5) from the vacuum cylinder (7) and pull off toward the rear over the piston rod (1) (Fig. 42-16/9).

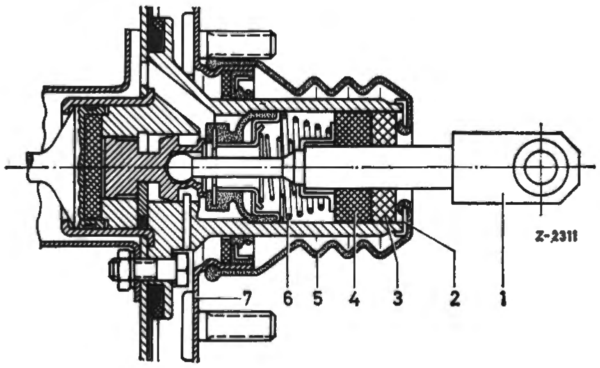


Fig. 42-16/9

1 Piston rod
2 Silencer bracket
3 Silencer
4 Filter
5 Protective cap
6 Control housing
7 Vacuum cylinder

3. Use two small screw drivers to remove the silencer bracket (2) from the control housing (6) and use a hooked needle to take the filter (4) and the silencer (3) out of the control housing and pull them over the piston rod.

Installation:

4. Insert a new filter and silencer into the control housing.

Note: The filter is twice as thick as the silencer and should be installed first. After installation turn the silencer so that the slots of the two elements are staggered by approx. 90°.

5. Insert the silencer bracket and pull on the rubber protective cap.

6. Install the power brake and the tandem master cylinder.

C. Replacement of Vacuum Check Valve

Note: On the 1st version power brake the vacuum check valve (21) in the form of an angle valve is attached directly to the power brake (Fig. 42-16/10), whereas as from chassis end numbers

Model	190 c	091 158	Model	220 SE sedan	066 097
	190 Dc	156 102		220 SE/c	066 143
	220 b	060 922		300 SE	005 689
	220 Sb	135 193		230 SL	006 869

the check valve (23) has been separated from the power brake and has been installed in the vacuum hose (19) (Fig. 42-16/11). The power brake itself is now only provided with a connector. Since there is no physical difference between the check valve and the connector the **vacuum check valve** has a **white housing** and the **connector** a **black housing.**

1st Version

Removal:

1. Detach the vacuum hose (19) for the check valve (21) (Fig. 42-16/10).

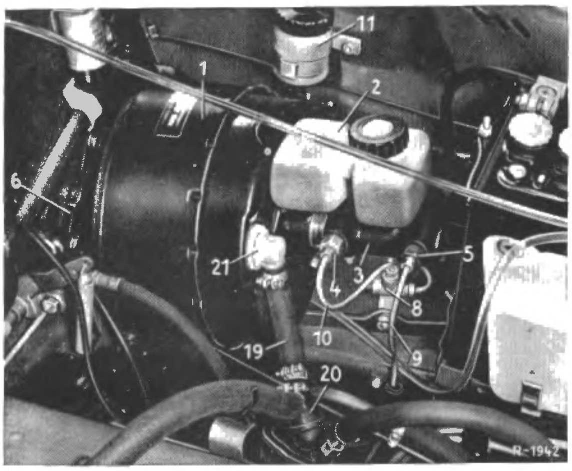


Fig. 42-16/10

Arrangement on Models 220 b, 220 Sb, 220 SEb

1 Power brake T 51/200
2 Reservoir
3 Tandem master cylinder
4 Connector with special check valve
5 Residual pressure valve
6 Intermediate flange
8 Distributor fitting
9 Brake line to rear wheel brake
10 Brake line to distributor
11 Reservoir for supply cylinder
19 Vacuum hose
20 Evaporator jar
21 Check valve

2. Use an SW 27 wrench to turn the check valve approx. 30° toward the tandem master cylinder and remove together with the sealing ring.

Installation:

3. Give the sealing ring a thin coat of special grease ESSO Norva 275 and put it on top of the check valve in such away that the coated surface points toward the power brake.

4. Fit the check valve to the power brake in such a way that the hose connection points toward the tandem master cylinder at an angle of 30°. Then use a hammer handle to push the valve toward the power brake and turn it downward.

5. Attach the vacuum hose to the check valve and check the connection for leaks.

2nd Version

During installation pay attention to the fact that the arrows on the check valve (23) point in the direction of the intake pipe and on Model 190 Dc in the direction of the vacuum pump.

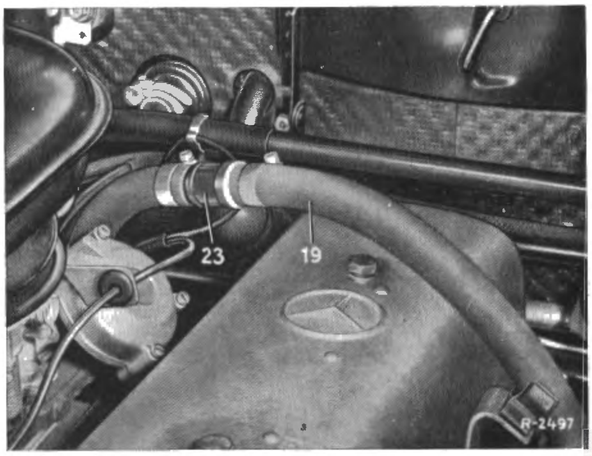


Fig. 42-16/11

Arrangement on Model 220 Sb

19 Vacuum hose
23 Check valve

Ratched and Brake Lever of Pistol-Grip Hand-Brake

Job No.
42-18

Modification: Two-circuit brake and Section D added

A. Removal and Installation of the Ratchet of the Pistol-Grip Hand-Brake together with the Hand-Brake Cable

Single-Circuit Brake

Removal:

1. Pull out the cotter pin from the brake lever (3) and detach the brake cable (2) from the brake lever (see Fig. 42-18/2).

Note: On the 2nd version without cotter pin, swivel the brake cable inward and then detach it from the brake lever.

2. Remove the inside cover and unscrew the bracket (21) of the ratchet at the support of the pedal system (see Fig. 42-18/1).

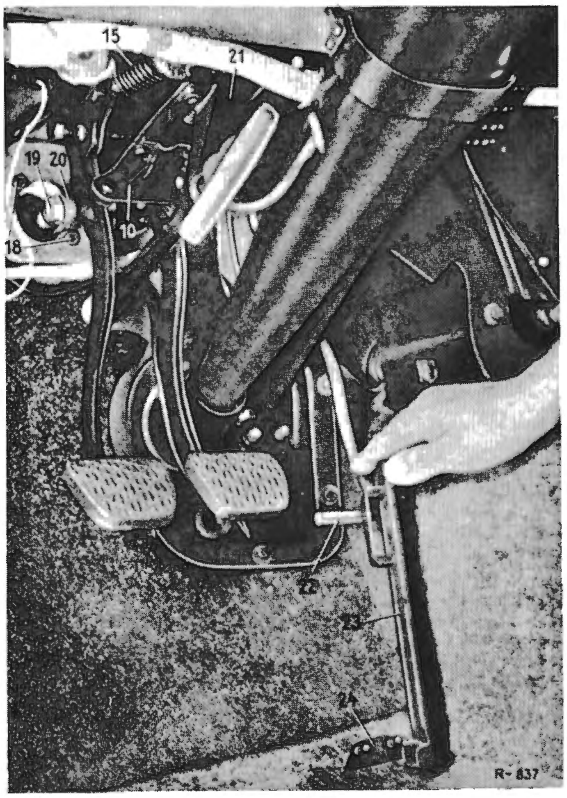


Fig. 42-18/1

10 Pedal Stop
15 Pressure spring (dead center spring)
19 Adjusting screw
20 Push rod
21 Bracket for ratchet
22 Adjustment lever
23 Foot plate
24 Ball-head bracket

Note: On cars with hand-brake warning light pull the plug out of the socket on the bracket of the ratchet.

3. Push the ratchet right to the front (in direction of travel) and tap out the guide pin from below through the bore in the guide tube.

4. Pull the ratchet out of the guide tube and detach the brake cable.

5. Pull the brake cable together with the rubber sleeve out of the cowl.

Installation:

6. Install the rubber sleeve of the brake cable in the cowl and push the cable inside.

Note: The rubber sleeve on the brake cable has been changed. Only the 2nd version (drawn out and dot-dash line) is supplied as a replacement part. If this version is installed as replacement of the 1st version rubber sleeve (drawn out line), the dot-dash part of the rubber sleeve must be cut off (Fig. 42-18/1a).

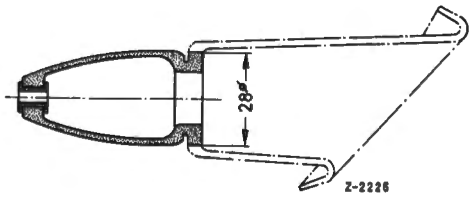


Fig. 42-18/1a

7. Lightly coat the ratchet with vaseline. Push the brake cable through the guide tube and attach it to the ratchet.

Note: The 2nd version ratchet has only 10 or 12 notches.

8. Use a screw driver to lift the pawl on the guide tube, and insert the ratchet with the cable in the guide tube.

Note: The 2nd version guide tube has a smoother guide curve in order to facilitate the return of the ratchet.

9. Knock the guide pin into the ratchet from above.

10. Screw the bracket to the support and install the cover. On cars with hand-brake warning light put the plug in the socket before installing the cover.

11. Check the functioning of the hand-brake warning light. When the hand-brake is applied the white pilot light must light up in the instrument cluster.

12. Attach the front brake cable to the brake lever, and on the 1st version, cotter.

13. Adjust the hand-brake (see Job No. 42-20, Section C).

Two-Circuit Brake

Removal:

1. Swivel the front brake cable (1) inward and detach from the brake lever (4) (see Fig. 42-18/5).

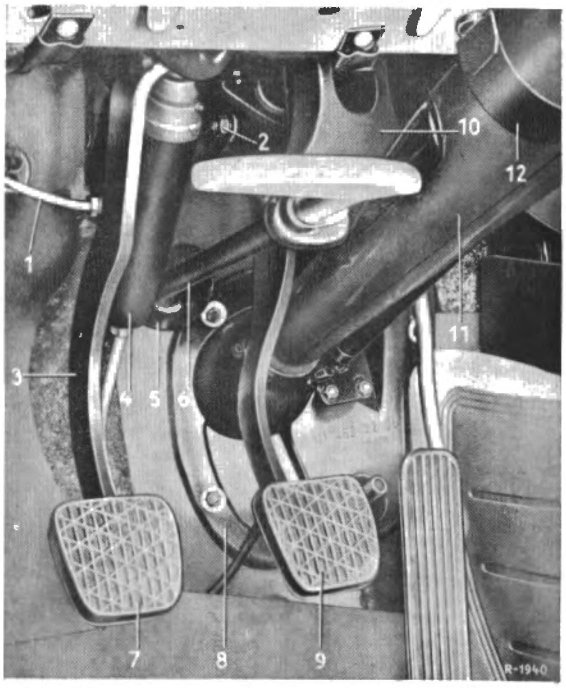


Fig. 42-18/2

1 Line from reservoir to supply cylinder
2 Adjusting screw with hexagon nut and lock washer
3 Clutch pedal
4 Supply cylinder
5 Rubber sleeve
6 Guide tube for ratchet
7 Clutch pedal foot plate
8 Cover plate
9 Brake pedal
10 Bracket for guide tube
11 Steering column jacket
12 Tightening strap

2. Remove the inside cover and pull the plug for the hand brake warning light out of the switch on the guide tube bracket (10) and unscrew the bracket from the pedal support (Fig. 42-18/2).

3. Remove the ratchet together with guide tube, the front brake cable, and the rubber sleeve.

4. Push the ratchet in the guide tube right to the front and tap out the guide pin from below through the bore in the guide tube. Detach the brake cable.

Installation:

5. Push the rubber sleeve (1) over the guide tube (3) (Fig. 42-18/3).

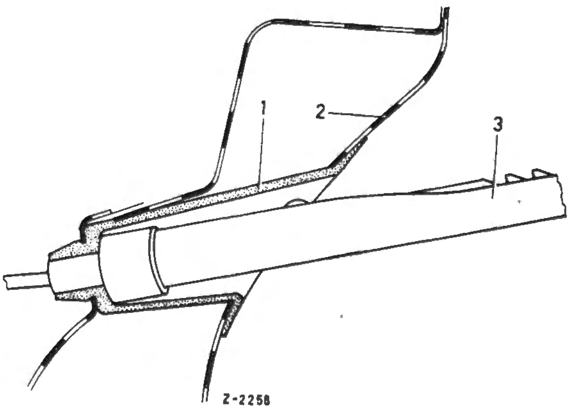


Fig. 42-18/3

1 Rubber sleeve 2 Cowl 3 Guide tube

6. Lightly coat the ratchet with vaseline. Push the brake cable through the guide tube and attach it to the ratchet.

7. Use a screw driver to lift the pawl on the guide tube, and insert the ratchet with the cable in the guide tube.

8. Knock the guide pin into the ratchet from above.

9. Push the brake cable through the cowl, and attach the bracket to the pedal support, making sure that the rubber sleeve is properly installed in the cowl.

10. Plug the hand brake warning light plug into the switch and check whether the warning light is working properly. When the hand brake is applied, the white light in the instrument cluster must light up.

11. Attach the brake cable to the brake lever.

12. Adjust the hand brake (see Job No. 42-20).

B. Removal and Installation of the Hand-Brake Lever, 1st version

Removal:

1. Unscrew the wing nut (1) from the center brake cable (7) and remove (Fig. 42-18/4).

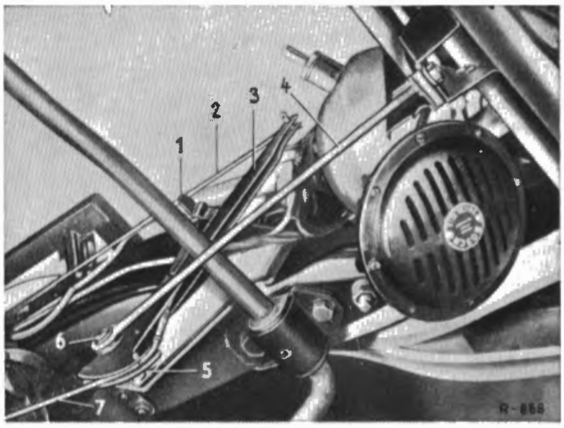


Fig. 42-18/4

1st version

1 Wing nut
2 Front brake cable
3 Brake lever
4 Pull rod
5 Cotter pin
6 Pivot pin
7 Center brake cable

2. Pull out the cotter pin from the brake lever (3) and detach the front brake cable (2) (Fig. 42-18/4).

3. Pull out the cotter pin (5) from the brake cable guide of the brake lever and remove the center brake cable from the brake lever (Fig. 42-18/4).

4. Remove the circlip from the pivot pin (6) of the brake lever (Fig. 42-18/4).

5. Screw out the hexagon nut of the pull rod (4) and remove the pull rod and the brake lever (3) (Fig. 42-18/4).

Installation:

6. When reinstalling the brake lever, make sure that the pull rod can be pushed easily on the pivot pin.

7. Adjust the hand brake (see Job No. 42-20, Section C).

C. Removal and Installation of 2nd version Brake Lever of Pistol-grip Hand-Brake

Removal:

1. Unscrew the wing nut (8) at the relay lever (5) (see Fig. 42-20/4).
2. Pull out the cotter pin from the brake lever (4) and detach the front brake cable (1) (Fig. 42-18/5).
3. Pull out the cotter pin (6) from the cable guide of the hand brake lever (4) and remove the center brake cable (5) (Fig. 42-18/5).
4. Bend the locking plate upward and screw out the hexagon screw (2) (Fig. 42-18/5).
5. Screw out the front hexagon nut at the pull rod (3) and remove the hand brake lever (4) together with the pull rod (Fig. 42-18/5).

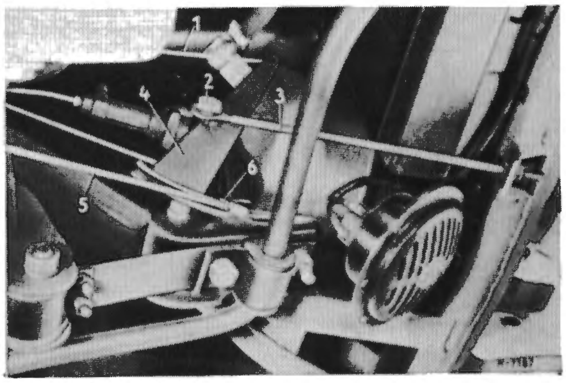


Fig. 42-18/5

2nd version

1 Front brake cable
2 Hexagon screw and locking plate
3 Pull rod for supporting hand-brake lever mounting
4 Hand brake lever
5 Center brake cable
6 Cotter pin

Installation:

6. When reinstalling the brake lever, make sure that the pull rod is adjusted to the correct length and that a new locking plate is used for the hexagon screw (2) (Fig. 42-18/5).

D. Removal and Installation of Hand Brake Lever on Model 230 SL

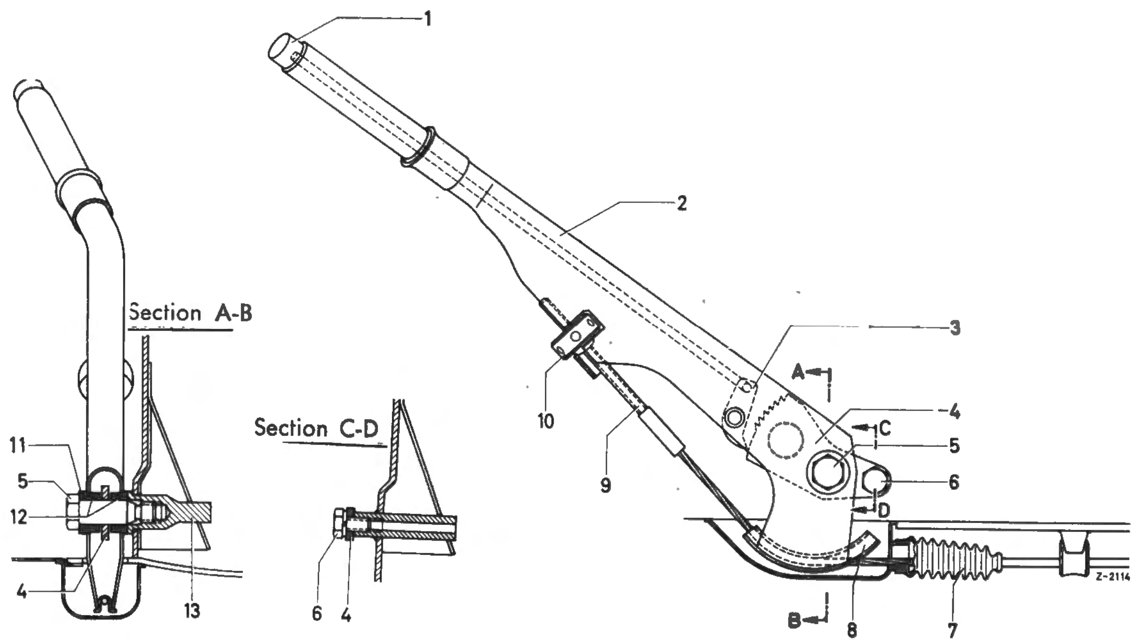


Fig. 42-18/6

1 Push button
2 Hand brake lever
3 Pawl
4 Toothed segment
5 Pivot pin
6 Hexagon screw with lock washer
7 Rubber sleeve
8 Brake cable guide
9 Front brake cable
10 Circular four-hole nut
11 Washer
12 Bearing bushing
13 Threaded member for fastening brake lever to chassis base panel

Removal:

1. Unscrew the circular four-hole nut (10) from the front brake cable (9) (Figs. 42-18/6 and 42-18/7).

Note: Use a 5 mm ⌀ steel rod to unscrew the circular four-hole nut.

2. Unscrew the pivot pin (5) from the threaded member (13) and remove together with the washer (11).
   Caution: Left-hand thread!

3. Push the push button (1) home and remove the brake lever (2) toward the front.

4. If the teeth of the toothed segment (4) should be damaged, remove the segment after unscrewing the hexagon screw (6).

5. Check the bearing bushings (12) in the brake lever for wear and replace, if necessary (Fig. 42-18/6).

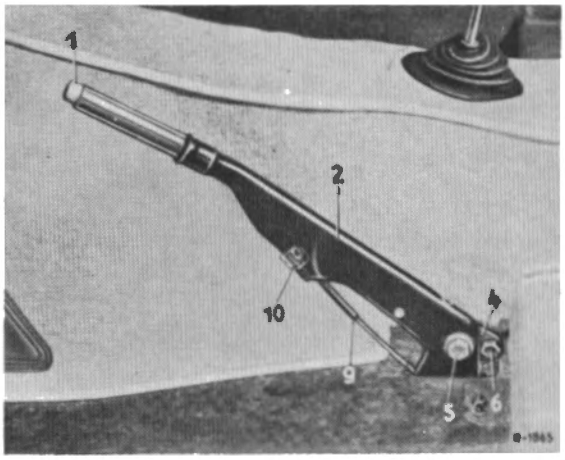


Fig. 42-18/7

1 Push button
2 Hand brake lever
4 Toothed segment
5 Pivot pin
6 Hexagon screw with lock washer
9 Front brake cable
10 Circular four-hole nut

Installation:

6. Attach the toothed segment (4) to the transmission tunnel without, however, tightening the hexagon screw (6).

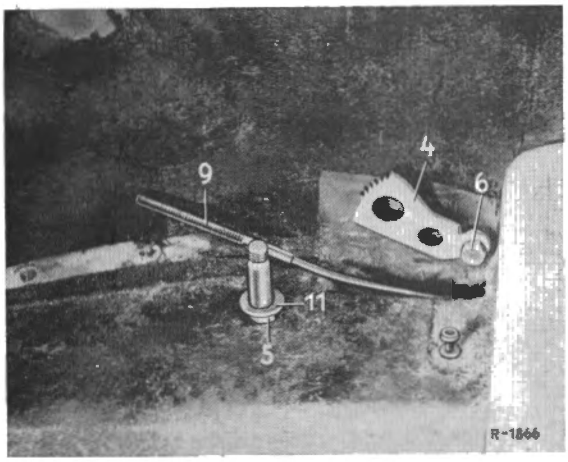


Fig. 42-18/8

4 Toothed segment
5 Pivot pin
6 Hexagon screw with lock washer
9 Front brake cable
11 Washer

7. Push the push button (1) home and insert the brake lever (2) from the front over the toothed segment.

8. Coat the pivot pin (5) with Molycote Paste Type "G" and screw into the threaded member (13).

9. Tighten the hexagon screw (6).

10. Check the hand brake lever for freedom of movement by pulling the lever and releasing it several times.

11. Insert the front brake cable (9) into the brake lever (2), making sure that the offset side of the rear brake cable threaded member points toward the front.

12. Screw on the circular four-hole nut and adjust the hand brake (see Job No. 42-20).

E. Removal and Installation of Front Brake Cable on Model 230 SL

Removal:

1. Detach the return spring (2) from the chassis base panel bracket and from the equalizer (3) (Fig. 42-18/9).

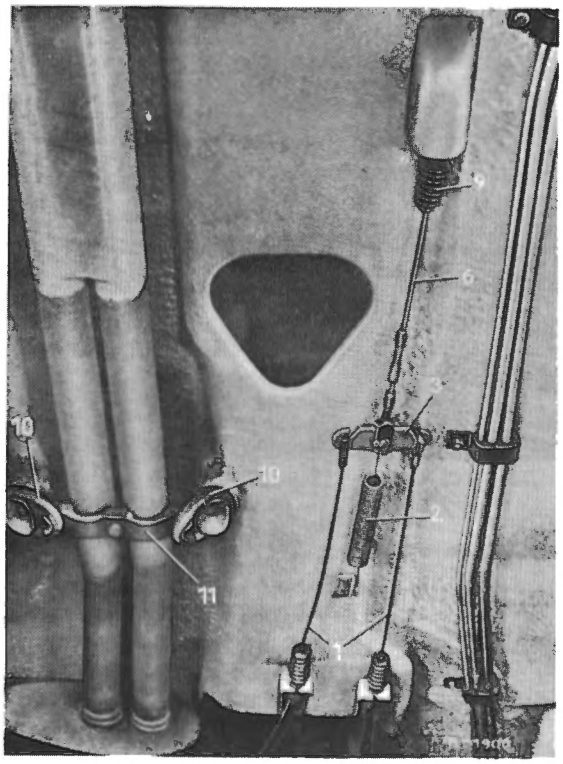


Fig. 42-18/9

1 Rear brake cable
2 Return spring
3 Equalizer
6 Front brake cable
9 Rubber grommet
10 Rubber ring
11 Lower bracket

2. Pull the cotter pin out of the collar bolt and remove the collar bolt from the equalizer and remove the front brake cable (6) from the equalizer (Fig. 42-18/9).

3. Remove the hand brake lever (see Section D).

4. Remove the brake cable.

5. Remove the rubber grommet (9) from the brake cable.

Installation:

6. Push a new rubber grommet on the front brake cable.

7. Insert the brake cable into the passenger compartment and install the brake lever.

8. Attach the front brake cable to the equalizer and attach the return spring.

9. Push the rubber grommet (9) on the bracket (Fig. 42-18/9).

10. Insert the brake cable (9) in the brake lever (2) making sure that the offset side of the threaded part on the brake cable points toward the front (see Fig. 42-18/7).

11. Screw on the circular four-hole nut and adjust the hand brake (see Job No. 42-20).

Center and Rear Brake Cable

Job No.
42-19

Modification: Note in para 8 added

A. Replacement of 1st version Center Brake Cable

Removal:

1. Unscrew the wing nut (1) from the center brake cable (7) and remove (see Fig. 42-18/2).

2. Pull the cotter pin (5) out of the cable guide plate of the brake lever (3). Pull the center brake cable (7) downward out of the brake lever (see Fig. 42-18/2).

3. Detach the return spring (3) from the collar bolt and from the bracket (4) on the chassis base panel (Fig. 42-19/1).

4. Remove the collar bolt from the center brake cable (1) and the equalizer (2).

5. Pull out the center brake cable toward the rear through the cable guides.

Installation:

6. During installation make sure that the guide lug on the center brake cable engages the brake lever.

7. Adjust the hand-brake (see Job No. 42-20, Section C).

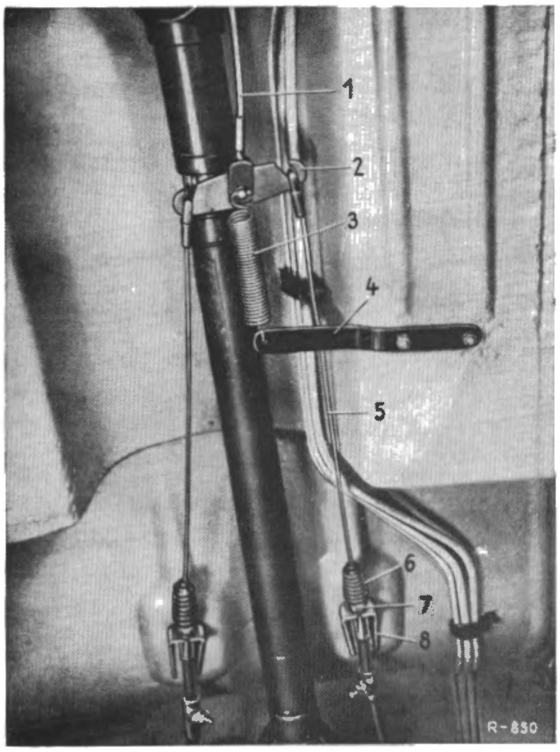


Fig. 42-19/1
1st version

1 Center brake cable
2 Equalizer
3 Return spring
4 Bracket
5 Rear brake cable
6 Rubber sleeve
7 Hexagon collar nut
8 Bracket on chassis base panel

B. Replacement of 2nd version Center Brake Cable

Removal:

1. Loosen the wing nut (8) at the relay lever (5) (Fig. 42-19/2).

2. Remove the collar bolt from the relay lever (5) (Fig. 42-19/2).

3. Pull out the cotter pin from the brake cable guide of the brake lever (4) and remove the brake cable (Fig. 42-18/3).

Installation:

4. During installation make sure that the brake cable at the multiple eyelet is properly fastened in the relay lever (5), i. e. when the hand brake is applied the relay lever must not bear against the guide end (7) (Fig. 42-19/2).

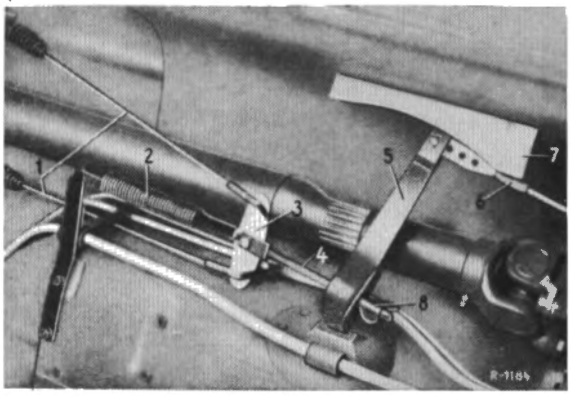


Fig. 42-19/2

2nd version

1 Rear brake cable
2 Return spring
3 Equalizer
4 Tensioning screw
5 Relay lever
6 Center brake cable
7 Guide for relay lever
8 Wing nut for adjusting the hand brake

Note: If the relay lever is removed or replaced take care to ensure that the proper relay lever corresponding to the particular version of the hand brake is installed (see Job No. 42-0).

C. Replacement of Rear Brake Cable

(Drum Brake)

Removal:

1. Remove the brake shoes on both sides (see Job No. 42-9).

2. Unscrew the pulley housing (5) from the brake anchor plate and pull it out of the brake anchor plate (Fig. 42-19/4).

3. After loosening the hexagon nut and lock washers and pulling out the hexagon screw, remove the pulleys from the two pulley housings.

4. Loosen the clamping screw (6) and pull out the cable guide from the two pulley housings (Fig. 42-19/4).

5. Detach the return spring from the equalizer and the bracket on the chassis base panel.

6. Loosen the wing nut on the brake or relay lever.

7. Loosen the hexagon collar nut (7) which secures the cable guide, remove the cables from the brackets (8) and detach them from the equalizer (2) (see Fig. 42-19/1).

Installation:

8. During installation make sure that the rubber sleeves (6) sit properly on the collar of the hexagon nut (7) since otherwise dirt will get into the cable guides (Fig. 42-19/1).

Note: On Model 230 SL attach the right brake cable to the rubber eyelet (Fig. 42-19/2a).

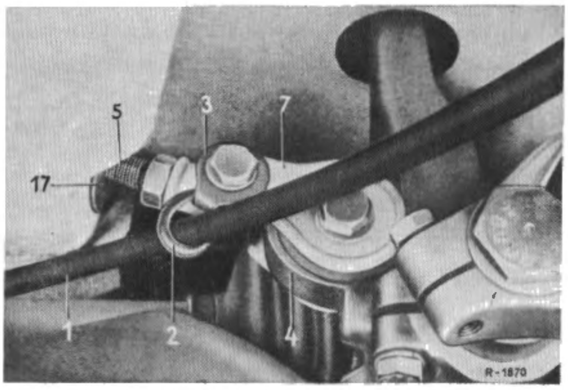


Fig. 42-19/2a

1 Rear brake cable
2 Rubber eyelet
3 Fixing clip
4 Bracket for rear axle suspension with rubber bearing
5 Cross strut
7 Link
17 Sleeve for lateral support

9. Tighten the hexagon screw (6) on the pulley housing sufficiently for the cable guide to be firmly in position (Fig. 42-19/4).

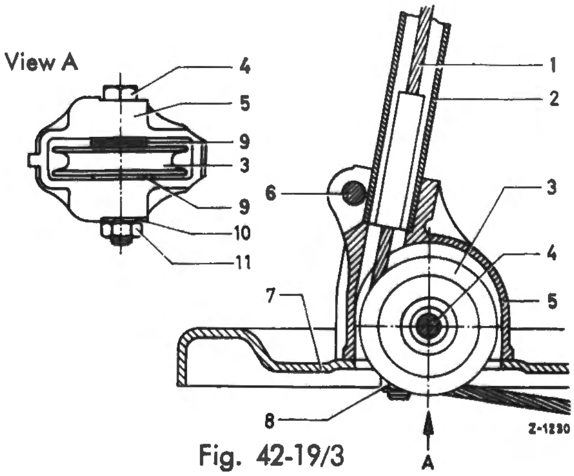


Fig. 42-19/3

1 Brake cable
2 Cable guide
3 Pulley
4 Hexagon screw
5 Pulley housing
6 Hexagon screw (clamping screw)
7 Brake anchor plate
8 Hexagon nut
9 Washer
10 Spring washer
11 Hexagon nut

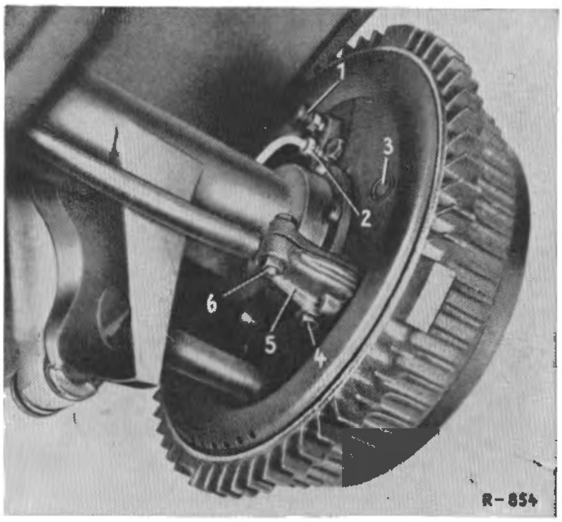


Fig. 42-19/4

1 Protector	4 Hexagon screw
2 Brake line	5 Pulley housing
3 Guide pin	6 Hexagon screw

10. After installation grease the rear brake cable. Do not overgrease, otherwise the grease may get into the rear wheel brake.

Note: On recent models the rear brake cables need no maintenance.

11. Adjust the hand brake (see Job No. 42-20, Section C).

D. Replacement of Rear Brake Cable

(Disk brake)

1. Back off the wing nut on the relay lever.

2. Loosen the hexagon collar nuts (7) for fastening the cable guides (Fig. 42-19/1), detach the cables (1) from the brackets and from the equalizer (3) (Fig. 42-19/5).

3. Unscrew the bracket (35) of the brake cable (39) from the brake support lever (41) (Fig. 42-19/6).

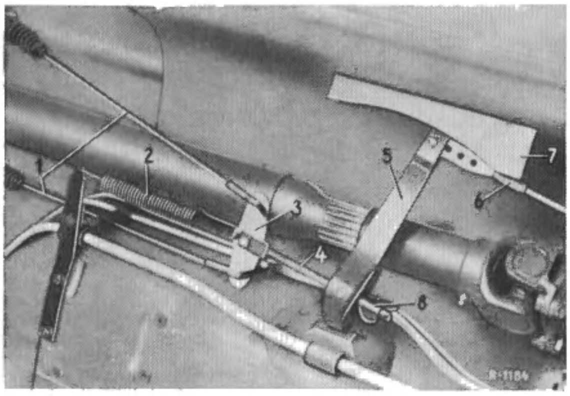


Fig. 42-19/5

1 Rear brake cables	6 Center brake cable
2 Return spring	7 Guide for relay lever
3 Equalizer	8 Wing nut for adjusting the hand brake
4 Tensioning screw	
5 Relay lever	

4. Bend the brake cable (39) upward and detach it from the hook of the tension lever (34) (Fig. 42-19/6).

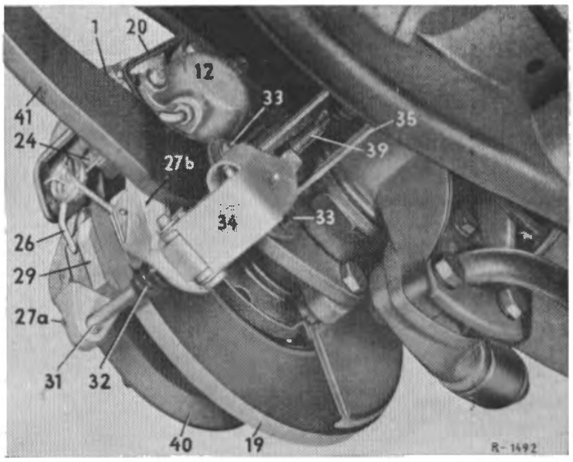


Fig. 42-19/6

1 Brake caliper	31 Adjustment screw
12 Pressure cylinder	32 Rubber grommet
19 Brake disk	33 Hexagon screw with lock washer
20 Connecting line	34 Tension lever
24 Locking plate	35 Rear brake cable bracket
26 Leg spring	39 Rear brake cable
27a Outer lining carrier	40 Wheel fixing disk
27b Inner lining carrier	41 Brake support lever
29 Friction pad (hand brake)	

Installation:

5. Attach the brake cable (39) to the tension lever (34) and fasten it to the brackets on the chassis base panel (Fig. 42-19/6).

Note: During installation make sure that the rubber sleeves are properly seated on the collar of the hexagon nut and the bracket.

6. Attach the bracket (35) of the brake cable to the lever (41) (Fig. 42-19/6).

7. Attach the cables (1) to the equalizer (3) and attach the return spring (2) (Fig. 42-19/1).

Note: When the relay lever has been removed or has been replaced take care to ensure that the proper relay lever for the car is installed (see Job No. 42-0).

8. Adjust the hand brake (see Job No. 42-20, Section C).

Adjustment of Brakes

Job No.
42-20

Modification: Section C and D added; Section E extended

A. Mechanical Adjustment of the Service Brake

1. After jacking up the car, check whether all the wheels turn freely.

Note: If a wheel does not turn freely, the cause must be discovered (brake shoes, brake wheel cylinder, or hand-brake cable jamming).

2. Turn the adjustment bolts on each wheel outward until the brake shoes fit snugly against the brake drums, i. e. until a considerable resistance can be felt when the wheel is turned.

Note: The brake shoes should be readjusted only when the brake drums are cold.

3. Back out the adjustment bolt until the wheel turn freely again.

4. Check the free play of the brake pedal (see Section B).

5. Press down the brake pedal to make sure that when the brake pedal is released the wheels can move freely again.

6. Adjust the hand-brake (see Section C).

7. After a trial run check again whether the brake releases properly.

B. Adjusting the Free Play of the Brake Pedal

(Single-circuit brake)

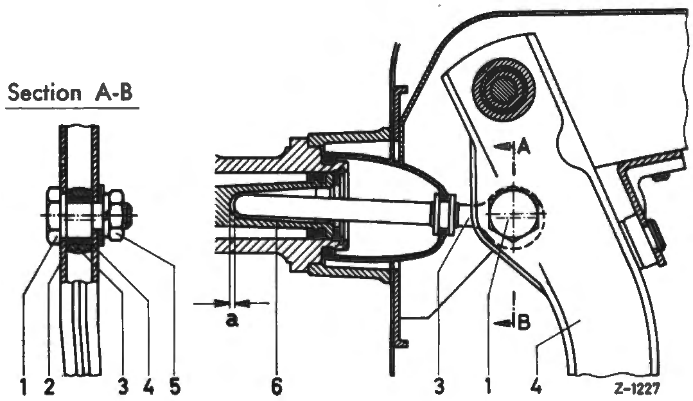


Fig. 42-20/1

1 Adjusting screw
2 Polyamide bushing
3 Push rod
4 Brake pedal
5 Hexagon nut
6 Piston
a = Clearance between push rod and piston

1. Check the free play of the brake pedal; it should be 4-5 mm.

2. If adjustment is necessary, loosen the hexagon nut (5) on the brake pedal and turn the adjustment screw (1) until the prescribed amount of free play has been reached (Fig. 42-20/1).

Note: The 4-5 mm free play of the brake pedal corresponds to a clearance of a = 0.5 to 0.7 mm between the piston push rod and the piston of the master cylinder (see also Fig. 42-3/1).

This clearance must be present under all circumstances otherwise the compensating port in the brake master cylinder cannot open and the brake fluid cannot flow back to the fluid reservoir. It is most important to carry out this check in the case of suspended brake pedals.

C. Adjusting the Brake Pedal Travel

(Two-circuit brake)

Note: On cars with two-circuit brake system the brake lever has no free play.

The adjusting screw on the brake lever, and on the relay lever on Model 230 SL, serves to adjust the brake pedal travel which on all models should be 152 mm.

Section A-B

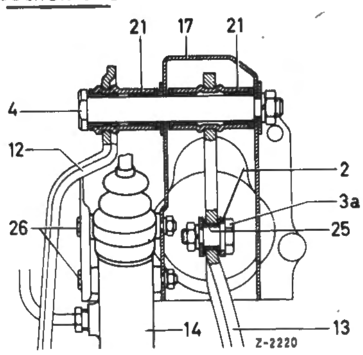


Fig. 42-20/2

Arrangement on all models with the exception of Model 230 SL

2 Piston rod of power brake
3a Adjusting screw with hexagon nut and lock washer
4 Pivot pin with hexagon nut and lock washer
12 Clutch pedal
13 Brake pedal
14 Supply cylinder
17 Pedal support
21 Bushings in the pedals
25 Bushings in the brake pedal
26 Hexagon screw with hexagon nut and lock washer

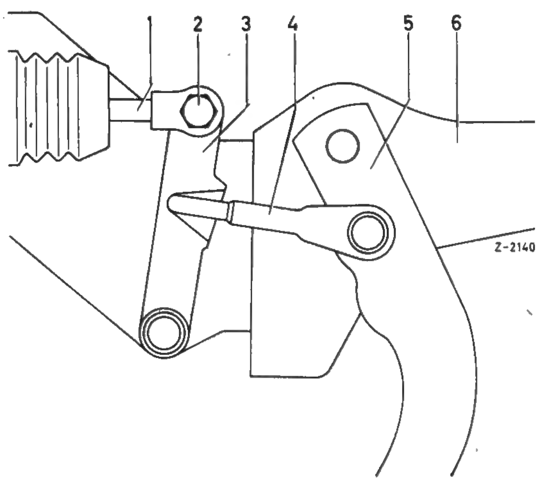


Fig. 42-20/3

Arrangement on Model 230 SL

1 Piston rod of power brake
2 Adjusting screw with hexagon nut and lock washer
3 Relay lever
4 Push rod
5 Brake pedal
6 Pedal support

1. On all models with the exception of Model 230 SL, turn the adjusting screw (3a) until the notch in the hexagon head points toward the rear. In this position the maximum brake pedal travel is obtained (Fig. 42-20/2).

Note: The notch in the hexagon head of the adjusting screw is in the direction of maximum eccentricity.

Since the brake pedal has no firm stop on the pedal support, adjustment must proceed from the final position of the power brake piston rod, making sure that the brake pedal does not rest aganist the brass threaded member of the stop light switch. The brown contact b...on should be visible approx. 4 mm. If the brake pedal comes into contact with the brass sleeve of the switch, the switch must be corrected by means of shims.

2. On Model 230 SL remove the plastic stop ring (11) from the hexagon nut and remove the stop light switch (10) (Fig. 42-20/4).

Note: Model 230 SL is provided with a plastic cap above the threaded member of the stop light switch which serves as a stop for the brake pedal. This stop is necessary since on Model 230 SL the push rod attached to the brake pedal loosely engages the relay lever; the brake pedal is not firmly attached to the piston rod of the power brake.

3. Turn the adjusting screw (2) on the relay lever until the notch which is arranged in the direction of maximum eccentricity points toward the rear.

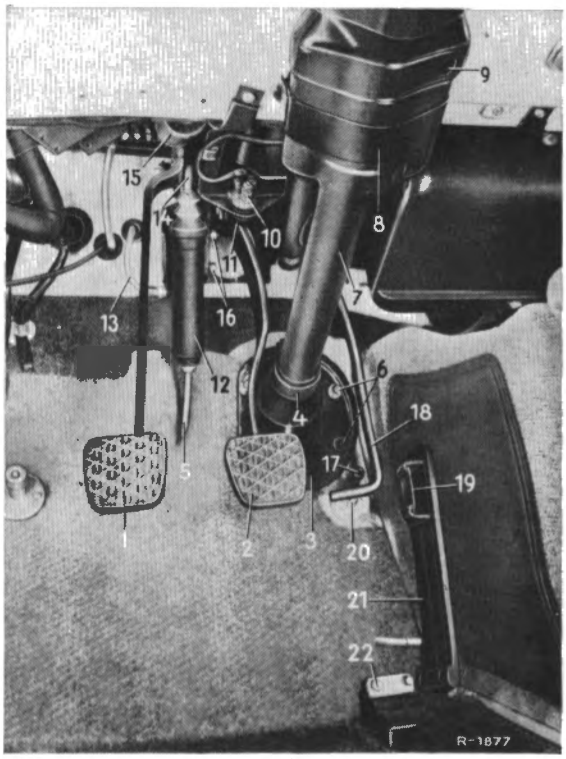


Fig. 42-20/4

1 Clutch pedal
2 Brake pedal
3 Cover plate
4 Pipe clip
5 Line to extraction cylinder
6 Hexagon screw with lock washer and shim
7 Steering column jacket
8 Tightening strap
9 Opening for clamp ring in steering column jacket
10 Mechanical stop light switch
11 Stop ring
12 Supply cylinder
13 Line from reservoir
14 Piston rod
15 Pressure spring (dead center spring)
16 Hexagon nut with lock washer
17 Stop screw
18 Control lever
19 Plastic plate
20 Hexagon nut
21 Foot plate
22 Ball-head bracket

4. Adjust the contact point of the mechanical stop light switch (see Section D).

5. After adjusting the contact point, the following check should be made:

1st Checking Method

Depress the brake pedal vigorously several times. Then turn one wheel on the front axle and open the bleed screw on the brake caliper of this wheel. If after opening the bleed screw the wheel is easier to turn, there is a residual pressure in the hydraulic system and the adjustment of the stop light switch must be checked again.

2nd Checking Method

Attach the residual pressure gage to the distributor fitting under the power brake and measure the decrease of pressure after depressing the brake pedal several times. If after releasing the brake the pressure does not fall to zero, the adjustment is wrong and should be corrected.

3rd Checking Method

If no residual pressure gage is available, the check can be made as follows:
Disconnect the brake line to the front wheel brake from the adaptor of the tandem master cylinder. Use a compressed air hose to blow air into the adaptor (max. air pressure 2 atm.) and check whether the air escapes into the reservoir via the compensating port. Caution: this compressed air check must only be used on cars delivered after the beginning of November 1963. On these cars the support ring on the piston of the tandem master cylinder has been peened.

D. Adjustment of Mechanical Stop Light Switch

The mechanical stop light switch (3) should be adjusted in such a way that the stop light lights up when the brake pedal (13) is being depressed by approx. 20 mm. This contact point of the stop light switch can be adjusted by means of shims (1).

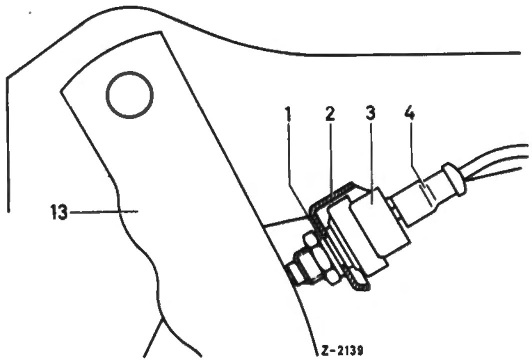


Fig. 42-20/5

1 Shim
2 Bracket for stop light switch
3 Stop light switch
4 Plug connection
13 Brake pedal

Note: The shims are available in 0.5 and 1.0 mm thicknesses.

When the brake is in the released position, the brake pedal must not rest against the brass threaded member of the brake light switch, but the brown plastic contact button must be visible about 4 mm.

On Model 230 SL the flat brass hexagon nut has been replaced by a hexagon collar nut to which the plastic stop ring is fastened. The hexagon collar nut represents the stop for the brake pedal and is required only on this model since the push rod on the brake pedal is not firmly connected to the relay lever.

On Model 230 SL the stop light switch is provided with a lock plate in order to prevent accidental turning of the switch.

E. Adjustment of Hand Brake

a) 1st Version Rear Wheel Brake (Malleable Cast Iron Brake Shoes)

Tighten the wing nut (1) on the brake lever (3) (Fig. 42-20/6) or the wing nut (8) on the relay lever (5) (Fig. 42-20/8) until the hand brake begins to take effect when there is a distance of 60—65 mm between the bracket of the guide tube and the damper ring on the ratchet. Correct adjustment of the wing nut enables the ratchet to be pulled out about 12—13 notches to provide a firm grip of the hand brake (Fig. 42-20/9).

Note: When the hand brake is in the released position, the rear wheel brakes must be free. The brake drums must not heat up noticeably when the brake is not actuated over a stretch of several miles. The car must coast to a halt without a jerk.

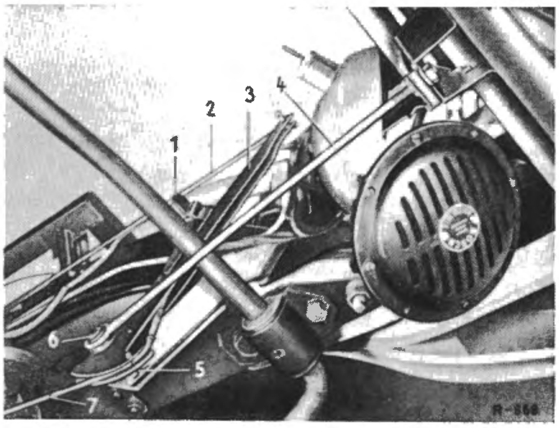


Fig. 42-20/6

1st version

1 Wing nut
2 Front brake cable
3 Brake lever
4 Support rod
5 Cotter pin
6 Pivot pin
7 Center brake cable

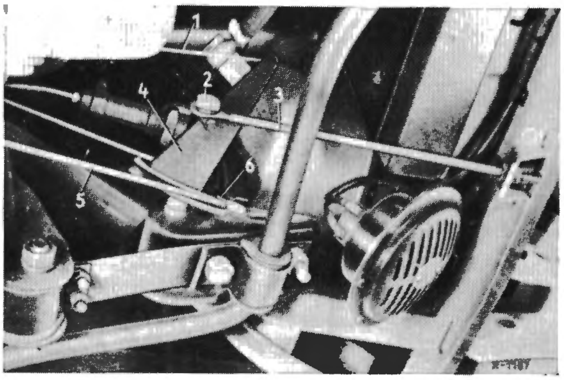


Fig. 42-20/7

2nd version

1 Front brake cable
2 Hexagon screw with locking plate
3 Pull rod for supporting
the hand brake lever mounting
4 Hand brake lever
5 Center brake cable
6 Cotter pin

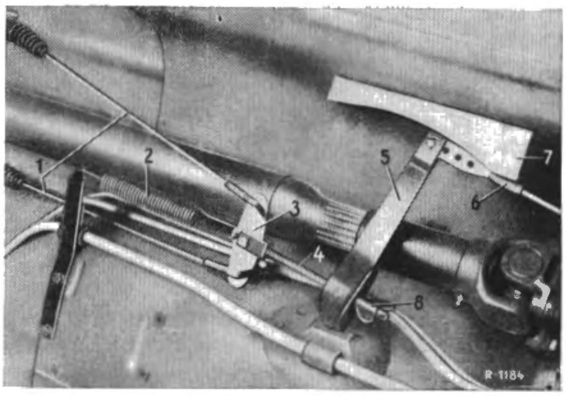


Fig. 42-20/8

2nd version

1 Rear brake cables
2 Return spring
3 Equalizer
4 Tensioning screw
5 Relay lever
6 Center brake cable
7 Guide for relay lever
8 Wing nut for adjusting the hand brake

Note: It is advisable to make a spacer sleeve in accordance with the dimensions given in Fig. 42-20/10.

On cars with malleable cast-iron brake shoes the dimension "a" should be 50 mm, and on cars with light metal brake shoes 60 mm.

The spacer sleeve is put on the ratchet in order to facilitate the adjustment of the hand brake.

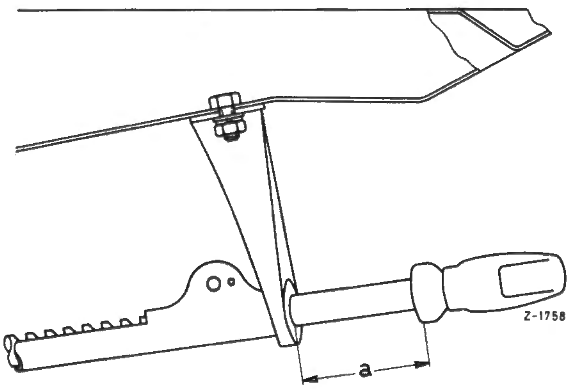


Fig. 42-20/9

a = 60—65 mm, in case of malleable cast iron brake shoes
a = 50—60 mm, in case of light-metal brake shoes

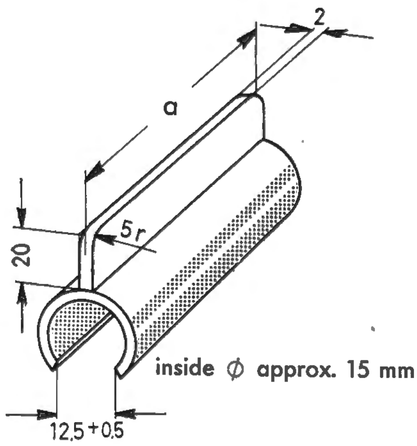


Fig. 42-20/10

Spacer sleeve

a = 65 mm

b) 2nd Version Rear Wheel (light-metal brake shoes)

The ratio of the 2nd version hand brake has been increased considerably with the result that the effective travel of the hand brake is much longer than in the case of the 1st version brake. When correctly adjusted the ratchet travel is appr. 17 to 19 notches before the hand brake is properly locked. The larger ratio considerably improves the braking action of the hand brake.

When adjusting the hand brake please note the following points:
The wing nut (8) at the relay lever (5) in the propeller shaft housing (see Fig. 42-20/8) should be adjusted in such a way that the brake takes effect when there is a distance a = 50—60 mm between the bracket at the guide tube and the ratchet.

In order to lock the hand brake the ratchet can be pulled by approx. 17 to 18 notches when 20 or 22 are available and it can be pulled out by approx. 5 to 6 notches when 10 notches are available (see Group 42-0). The 10-notch ratchet can be pulled out much further until the first notch is engaged since the first 10 notches have been dispensed with.

It is imperative that after adjustment a check is made to ensure that the rear wheels turn freely when the hand brake is completely released. There must be no contact whatsoever between brake shoes and drum.

If the relay lever should move toward the end of its guide when the wing nut is being turned, the lever must be attached to the next hole of the center brake cable (change the position of the bolt and cotter again).

Note: Check the free movement of the relay lever on the bottom of the guide and if necessary use a punch to dish it.

If in the case of badly worn linings this adjustment proves insufficient, i. e. if no or insufficient braking effect is produced on the rear wheels, further adjustments must be made on the rear wheel brakes themselves. Before this is done check the service brake for proper adjustment and if necessary adjust it by means of the eccentrics. Then back out the wing nut of the relay lever until the two brake cables for the rear wheel brake are slack. Then adjust the push rod (3) by turning the adjusting wheel (2) until the prescribed clearance "b" between push rod and brake shoe is obtained (Fig. 42-20/11). Although the push rod can be adjusted through the opening in the brake anchor plate, the push rod, **contrary to our previous instructions, should only be adjusted after the brake drum has been removed.**

With a screw-driver clamped between the brake lever and the rear brake shoes and by slightly moving the brake lever it is possible to check whether the necessary clearance "b" is present at the push rod, since if there is no or too small a clearance one of the two brake shoes will move immediately.

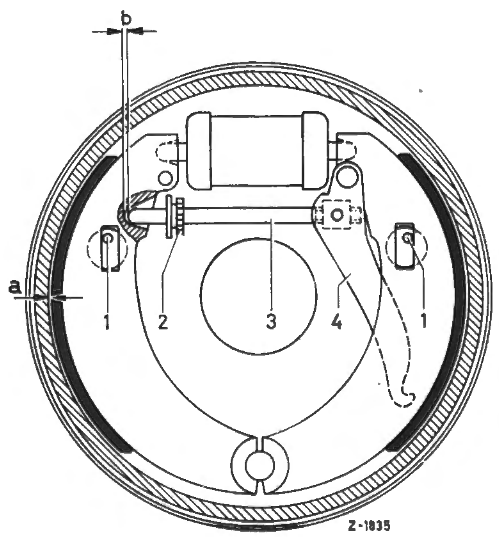


Fig. 42-20/11

1 Eccentric
2 Adjusting wheel
3 Push rod
4 Brake lever

a Clearance between brake shoe and brake drum appr. 0.3 mm
b Clearance between push rod and brake shoe appr. 1.0 mm

Please note that if the upper return spring exerts heavy pressure on the adjusting wheel of the push rod, the push rod is pulled back insufficiently.

The push rod should therefore always be pushed back before the clearance is checked. When the brake drum and the rear wheels have been installed, adjust length of the brake cables **by means of the wing nut on the relay lever (see Job No. 42-0). With the hand brake in the released position the rear wheels must be able to move without any friction.** The brake drums must not be warm to the touch after the car has traveled several miles without the brake having been applied.

Note: When the service and hand brakes have been adjusted correctly the brake shoes should rest against the eccentrics and should on no account bear against the push rods.
When the hand brake is adjusted by means of the wing nut, the clearance "b" between push rod and front brake shoe is reduced; however a certain amount of clearance is essential.

On recent cars a warning light has been installed which lights up white when the ignition is switched on and the hand brake is either locked or only partially released. This warning light is actuated by a lug on the ratchet handle which presses against the pin of a pressure switch attached to the bracket of the guide tube.

At the same time the ratchet grip was extended by 40 mm in order to improve the accessibility of the hand brake.

c) Rear Wheel Brake 3rd Version (malleable cast iron brake shoes)

As on previous models, the hand brake should be adjusted by means of the wing nut of the relay lever in the propellor shaft housing. The hand brake is properly adjusted when then ratchet can be pulled out by approx. 5 to 6 notches of the 10 or 12 notches available on the ratchet. The hand brake can no longer be adjusted on the rear wheel brake since the adjustable push rod on the brake lever has been replaced by the brake lever strut.

d) Disk Brake on Model 300 SE

On Model 300 SE adjustment or readjustment of the hand brake is no longer necesssary since the lining carriers with the friction pads are automatically adjusted in the hand brake caliper, i. e. when the hand brake is released, there is always a distance of approx. 0.2 mm between the brake disk and the friction pads. The wing nut in the relay lever in the propeller shaft housing only serves to correct the length of the brake cables. If after certain repair procedures is should be necessary to check or adjust the hand brake, please proceed as follows:

Center Brake Cable:

With the ratchet completely released, attach the four-hole end-piece of the center brake cable (6) to the relay lever (5) in such a way that the distance from center cotter pin hole of the guide plate (7) to center bore relay lever (for center brake cable) is a = 20 to 40 mm (Fig. 42-20/12).

Rear Brake Cables

Back out the wing nut (8) on the tensioning screw (4) until the tension levers of the hand brake caliper are in their released position (see Fig. 42-20/12). Then tighten the wing nut until the tension levers are just beginning to move. Proceeding from this adjustment, back off the wing nut one half turn. Then actuate the ratchet several times so that the distance between lining carrier and brake disk can adjust itself properly (approx. 0.2 mm clearance between the brake lining of the friction pad and the brake disk). When the length of the brake cable has been properly adjusted, it should be possible to pull out the ratchet 5 to 10 notches with medium force.

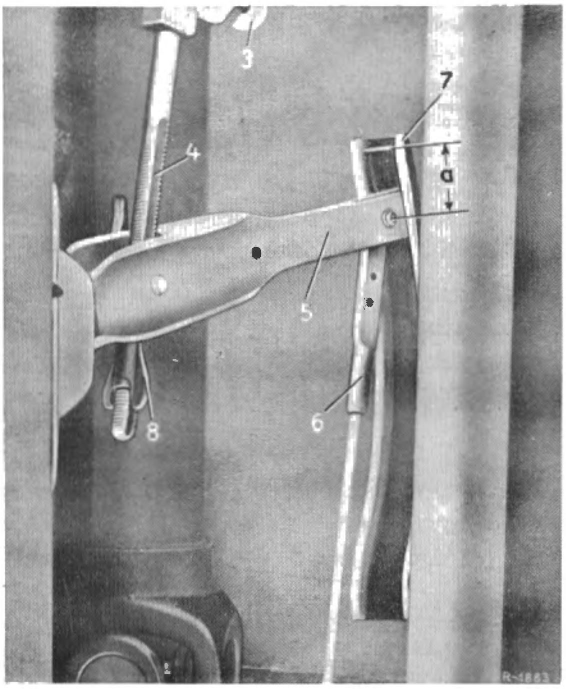


Fig. 42-20/12

3 Equalizer
4 Tensioning screw
5 Relay lever
6 Center brake cable
7 Guide for relay lever
8 Wing nut

e) Lever Hand Brake on Model 230 SL

Use a steel rod to tighten the circular four-hole nut (10) on the brake lever (2) to the point where with medium force the brake lever can be pulled about 3 notches of the 6 notches on the toothed segment.

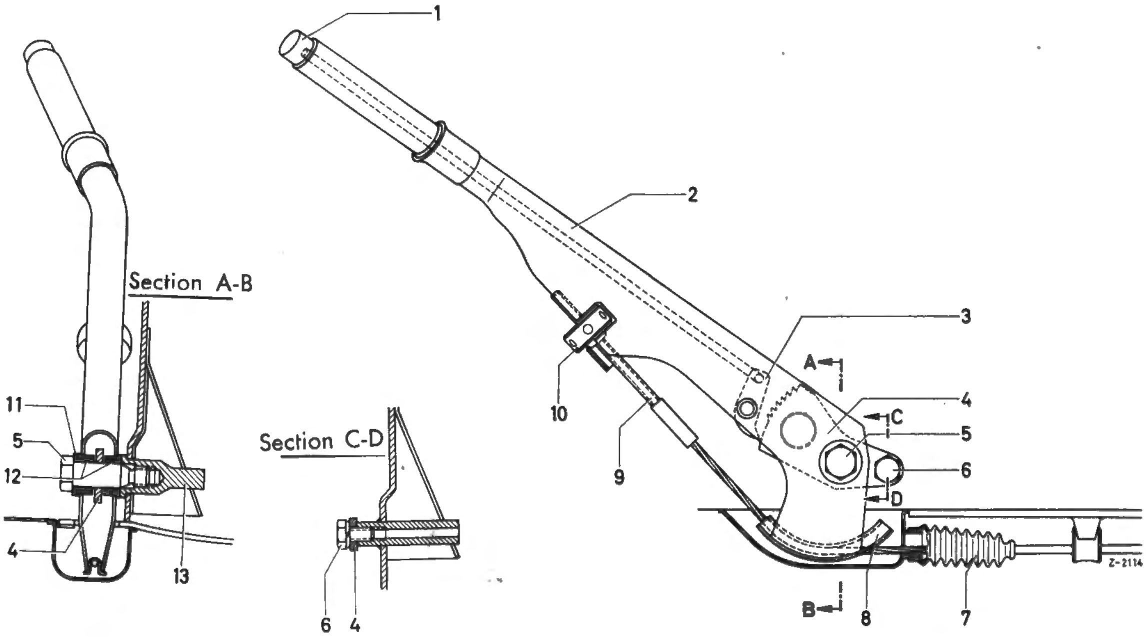


Fig. 42-20/13

1 Push button
2 Hand brake lever
3 Pawl
4 Toothed segment
5 Pivot pin
6 Hexagon screw with lock washer
7 Rubber sleeve
8 Brake cable guide
9 Front brake cable
10 Circular four-hole nut
11 Washer
12 Bearing bushing
13 Threaded member for fastening brake lever to chassis base panel

F. Duo Servo Brake

Readjustment:

Note: The hand brake must be readjusted if with medium force the ratchet can be pulled more than 8 notches (of a total of 16) without producing any brake action.

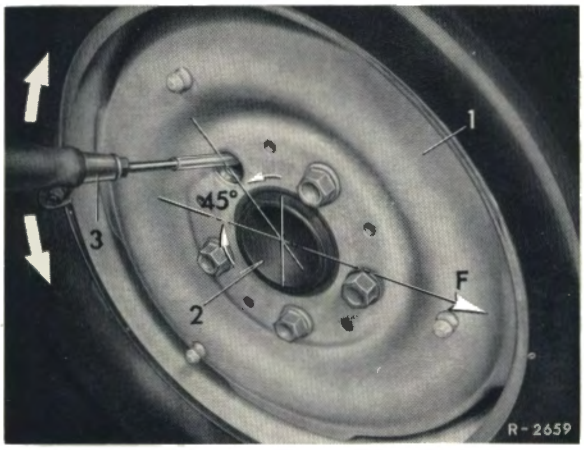


Fig. 42-20/14

1 Disk wheel
2 Rear axle shaft
3 Screwdriver
F = Direction of travel

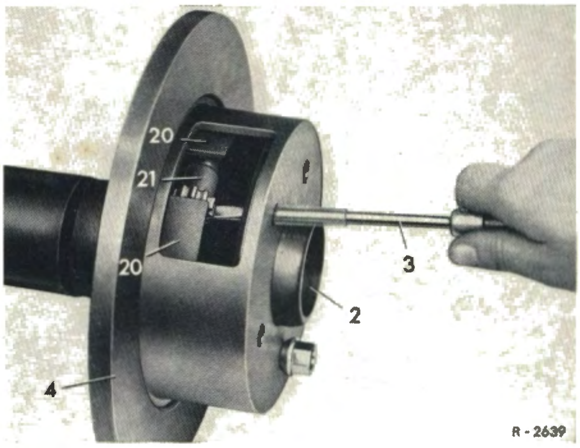


Fig. 42-20/15

2 Rear axle shaft
3 Screwdriver
4 Brake disk
20 Brake shoes
21 Readjusting device

1. Screw out one spherical collar screw each at the left and right rear axle.
2. Jack up the car and turn one wheel until the screw hole from which the spherical collar screw was removed points in the upper rear direction at an angle of approx. 45° (Fig. 42-20/14).
3. Insert a screwdriver with a 4.5 mm. blade through the hole in the disk wheel and engage the toothed wheel of the readjusting device. Turn the toothed wheel until the road wheel is on the point of being locked. Turn the toothed wheel back by 2-3 teeth, i.e. as much as is necessary to free the road wheel completely.

Caution: On the left side move the screwdriver upward to force the brake shoes against the drum. On the right side move the screwdriver downward.

4. After readjustment make the following check:

   Pull out the ratchet one notch; in this position the rear wheels must still have full freedom of movement.

Note: When readjusting the hand brake never adjust the wing nut of the relay lever. Its only purpose is to equalise the brake cable lengths.

Basic Adjustment:

Note: Basic adjustment is necessary when e.g. the rear axle or one of the brake cables have been replaced.

1. Turn out the wing nut (8) on the relay lever (5) (see Fig. 42-20/8).
2. Adjust the duo servo brake (see Section F, paras 1–4).
3. Tighten the wing nut on the relay lever until the ratchet can be pulled out with medium force (appr. 40 kg) appr. 5–6 notches. Then check whether the rear wheels turn freely when the ratchet is pulled out 1 notch.

Checking the Brake System

Job No.
42-21

Modification: Revised, Instructions for Model 230 SL added in Section A. Sections F, G and H added.

A. Excessive Brake Pedal Free Play

All hydraulic brakes must be thoroughly bled and carefully adjusted in order to achieve the maximum braking effect and the shortest possible brake pedal free play. If complaints are received about excessive brake pedal free play, this may be due to the following causes:

1. Bleeding

It is possible that in certain cases the air mixes with the brake fluid and as a consequence is finely suspended in the brake fluid. Since the air is not always eliminated immediately, it is advisable to bleed the brake system carefully several times and if necessary to repeat this after some days.

2. Adjustment of the brake shoes

Make sure that the brake shoes with mechanical adjustment are properly adjusted. On models 220 Sb and 220 SEb 1st version with automatic brake shoe adjustment check the proper functioning of the automatic brake shoe adjustment.

3. Master Cylinder (only for vehicles with single-circuit brake system)

Check whether the master cylinder is functioning properly. When the brake is in the non-applied position, i. e. when there is a play of 0.5–0.7 mm between the piston and the push rod, the piston must rest against the piston stop washer.

4. Residual pressure in the lines

Check the residual pressure which is only required in cars with drum brakes. If the residual pressure in the system is not available the check valve must be removed and replaced. According to the design of the brake system the check valve may be installed in the master cylinder, in the primary pressure valve or in the hydraulic slave cylinder of the power brake T 50/24/1 or in the tandem master cylinder.

5. Leak test of the brake system

Check the whole hydraulic system for leaks. To do this remove the dust caps of the wheel cylinders, in the case of Girling brake calipers lift the dust cap in the groove of the piston after having removed the friction pads, and in the case of Dunlop brake calipers remove the dust cap from the pressure cylinder after having removed the friction pads. Check possible loss of brake fluid at the leak bore of power brake T 50 or the tandem master cylinder. When no leaks are discovered and brake fluid is lost nevertheless there is a chance that on vehicles with a power brake of the T 50 series the fluid gets into the vacuum cylinder because the leak bore is choked or there is a leak in the sleeve of the control valve piston of the power brake.

6. Rear Wheel brake with light metal brake shoes

A difference in brake pedal free play has sometimes been observed on individual cars when the car was braked for the first time after a certain mileage.

As a rule, increasing wear of the brake linings is clearly indicated by a corresponding increase in brake pedal free play and this can be used as a safe guide for determining when brake shoe ad-

justment is necessary. However, it may happen in individual cases that brake shoes with a considerable amount of wear, particularly on the rear wheels, are not immediately pulled right back to the eccentrics by the return springs; they stick. This condition is not noticeable when braking is repeated immediately. If, however, the car is braked after a few miles the brake pedal free play is suddenly larger because in the meantime the brake shoes have reached their end position as a result of travel vibrations, and the increased distance from the brake drum requires a larger brake fluid volume. Such faults will be less noticeable on cars with a larger master cylinder and a large brake fluid volume than on cars with a smaller master cylinder and a corresponding smaller fluid volume.

As a remedy the following procedures are recommended:

a) Front wheel brake

Carefully remove any dust from the brake system and remove the brake shoes. Lightly coat the contact plate for the brake shoes and the anchor pins with Molycote Paste type "G" and reinstall the brake shoes.

Caution, do not use too much Molykote Paste! When installing the washer (6) take care to ensure that there is no ridge on the washer and that the smooth side of the washer points toward the brake shoe. Also lightly coat the contact face of the washer with Molycote Paste (Fig. 42-21/1).

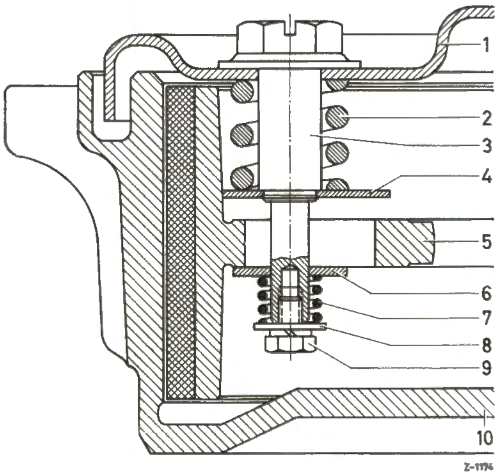


Fig. 42-21/1

1 Brake anchor plate
2 Pressure spring
3 Adjustment bolt
4 Eccentric
5 Brake shoe
6 Washer
7 Pressure spring
8 Washer
9 Hexagon screw
10 Brake drum

b) Rear wheel brake

Carefully remove any dust from the brake system and remove the brake shoes. It is advisable to replace all return springs. Before reinstalling the brake shoes, coat all contact points with Molycote Paste, especially the contact surfaces, the anchor pin on the brake anchor plate and the brake lever on the rear brake shoe.

When reinstalling the brake shoes make sure that the return springs are not overtensioned.

c) Master cylinder

On models 190 c and 190 Dc replace any 1st version master cylinder of 7/8" ⌀ by a 2nd version master cylinder of 15/16" ⌀ according to Part No. 000 420 93 01. This 15/16" master cylinder has been installed as a standard part as from chassis end numbers:

Model 190 c	10 368
Model 190 Dc	14 450

7. Model 230 SL

If the brake pedal free play is found to be variable and the brakes fail to release or to release properly, a binding relay lever (19) in the bearing bracket (20) is responsible. When the relay lever, which transmits the pressure on the brake pedal to the piston rod (2) of the power brake (1), does not move easily the power brake returns very slowly to its released position. To prevent relay lever binding, the diameter of the bore in the relay lever for the collar bolt (18) has been increased as from chassis end no. 011 319 (Fig. 42-21/1b). For repairs on older cars, a thinner collar bolt, Part No. 113 991 00 07 is available, which can be easily recognised by its 5 mm projection (Fig. 42-21/1a).

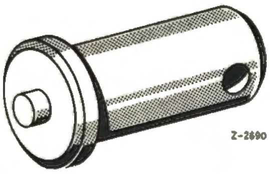


Fig. 42-21/1a

Whenever complaints are received about excessive brake pedal free play, check the freedom of movement of the relay lever as follows:

a) Open a bleed screw in the front axle brake circuit and depress the brake pedal as far as it will go.

b) In this position hold the piston rod of the power brake and screw out the adjusting screw (3) connecting the piston rod to the relay lever.

c) Move the relay lever. If it moves easily proceed as described in para i.

Whenever there is the slightest stiffness in the relay lever movement install the new thinner collar bolt as described below:

d) Draw off the brake fluid from the reservoir of the clutch actuating mechanism and remove the reservoir together with the bracket.

e) Pull the cotter pin out of the collar bolt (18). Remove the washer and take the collar bolt out of the bearing bracket (20).

f) Remove the spring washer from the collar bolt and put it on the new collar bolt. Grease the collar bolt and install it in bearing bracket and relay lever.

g) Put the washer on the collar bolt and cotter.

h) Install the reservoir and fill it with brake fluid.

i) Close the bleed screw in the front axle brake circuit. Screw the adjusting screw into relay lever and piston rod, making sure that the screw slot points toward the rear.

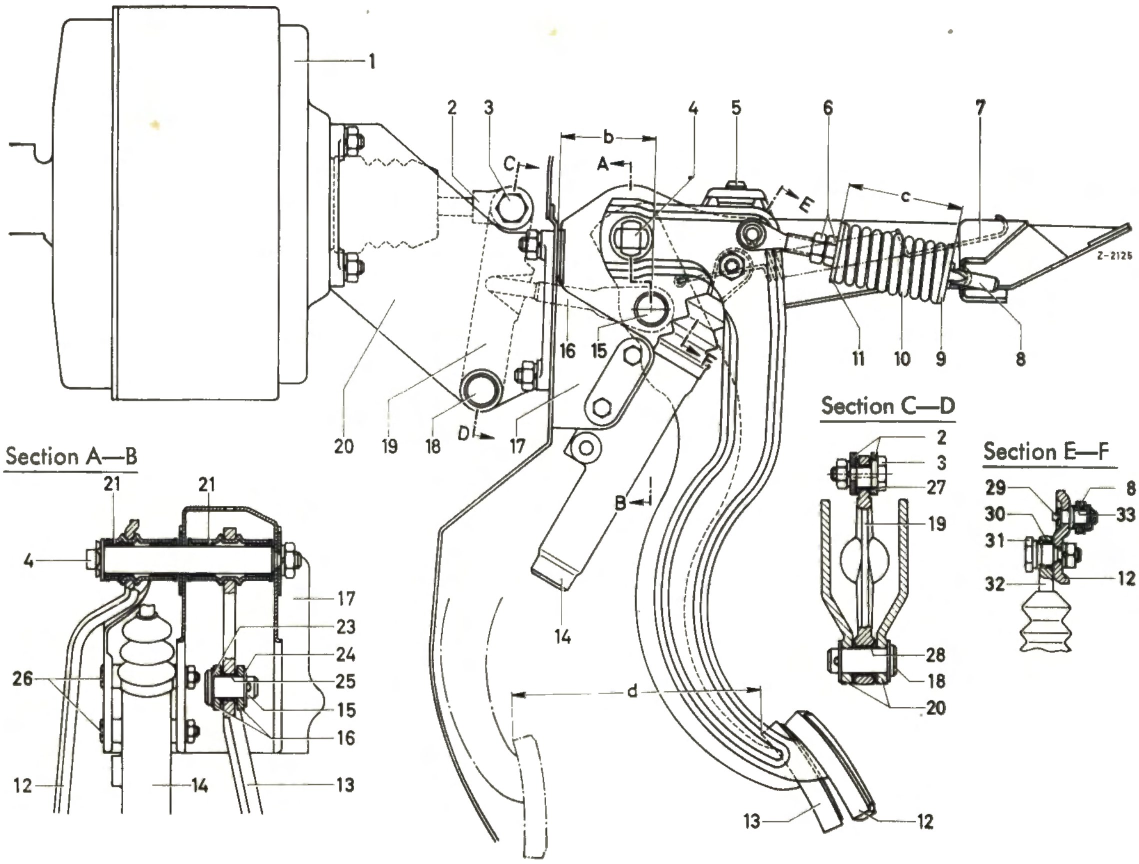


Fig. 42-21/1b

b = Control dimension for brake pedal
c = Adjusting dimension for pressure spring (dead center spring)
d = Brake pedal free play until it rests against the cowl

1 Power brake T 51/200
2 Piston rod of power brake
3 Adjusting screw with lock washer
4 Anchor pin
5 Rubber stop for clutch pedal
6 Hexagon nut
7 Return spring for brake pedal
8 Push rod for pressure spring
9 Spring retainer
10 Pressure spring (dead center spring)
11 Spring retainer
12 Clutch pedal
13 Brake pedal
14 Supply cylinder
15 Collar bolt
16 Push rod for relay lever
17 Support for pedal system
18 Collar bolt with washer and cotter pin
19 Relay lever
20 Bearing bracket
21 Bushing for brake and clutch pedals
23 Spring washer
24 Washer
25 Bushing in brake pedal for collar bolt
26 Hexagon screw with lock washer and hexagon nut
27 Bushing in relay lever for adjusting screw
28 Bushing in relay lever for collar bolt
29 Anchor pin for push rod
30 Bushing in piston rod
31 Adjusting screw with lock washer and hexagon nut on clutch pedal
32 Piston rod
33 Bushing in push rod

B. Roughness of the Brake and Tendency to Rattle

In case of complaints that the brakes are rough and have a tendency to rattle, it is necessary not only to check the brake system, but also to make sure that the wheels are properly balanced and that the rims have no excessive eccentricity or run-out, that the front and rear shock-absorbers work properly (shock-absorbers on one axle should be adjusted to the same dimensions as far as possible), and that the rear axle is properly installed and is not subject to any stress. It should also be remembered that the proper functioning of the brake system depends to a large extent on the proper installation of the brake shoes. The following procedures should be followed to reestablish proper brake functioning:

1. Brake linings

First of all check the wear pattern of the brake linings. In order to improve the wear pattern lightly sandblasted brake drums can be used or else the brake linings can be reconditioned e. g. by the Zanchi turning attachment. Sandblasted brake drums should not be used for Johns-Manville brake linings since these linings are too soft. When these soft brake linings are installed, the brake drums should be precision-turned since this produces sufficient roughness to obtain a satisfactory wear pattern after a few brake actions. Lightly sandblasted brake drums need not be removed from the vehicle since the roughness of these brake drums will disappear after a few brake actions.
If even sandblasted or precision-turned brake drums do not produce a satisfactory wear pattern on the brake linings, the brake linings are deformed and must be replaced.

2. Spring-loaded Pressure Pins

Any spring-loaded pressure pins installed on models 220 Sb and 220 SEb 1st version must be checked for ease of movement. The pin must easily move in the sleeve. Dirty pressure pins should be cleaned and the sliding surfaces should be lightly coated with Molykote Paste Type 'G'. In addition check whether cup springs of 15 mm diameter have been installed since these produce a travel at the brake shoe which is approx 0.3 mm shorter than the travel on the 1st version with a 20 mm diameter. The cup springs must be properly mounted and must have sufficient initial tension.

When spring-loaded pressure pins are installed subsequently make sure that particularly on cars without power brake the brake pedal free play is not excessive. For this reason no more than two spring-loaded pressure pins should be installed in any one vehicle.

3. Brake drums

Check the brake drums for accurate wall thickness over the whole circumference. Center displacement of the brake drums which can be recognized by uneven wall thickness has an unfavourable influence on brake rattle even when the brake drums are properly balanced. Such brake drums should always be replaced.

Brake drums with scores or burnt spots should be returned as accurately as possible. Burnt spots of any considerable size cannot be removed by turning, and such brake drums should therefore always be replaced. When turning brake drums make sure that the specified dimensions are maintained (see Job No. 42-0). When using well-ground and lapped Widia tools a cutting speed of approx. 80 meters/minute at a feed of 0.12 mm/rev. should not be exceeded.

Check the contact of the dished wheel disk with the brake drum. It may happen in some cases that the dished wheel disk presses against the bevel of the brake drum (see arrow in Figs. 42-21/2 and 42-21/3). As a result the brake drum will be strained when the wheel nuts are tightened. The dished wheel disk should only rest against the faced part of the brake drum; if this is not the case

the brake drum must be replaced. On the 2nd version brake drum the bevel was moved slightly toward the outer diameter. Consequently the distance 'a' (see Fig. 42-22/4) indicates the difference in the two brake drum designs;

distance 'a' 1st version 174.5 mm Ø
distance 'a' 2nd version 178 mm Ø

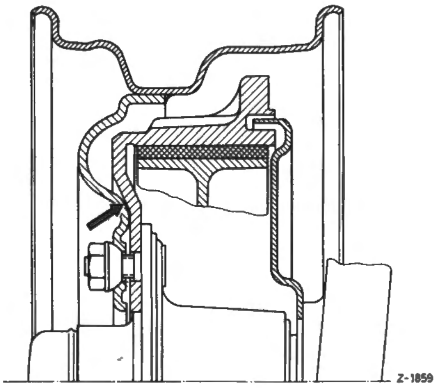


Fig. 42-21/2
1st version

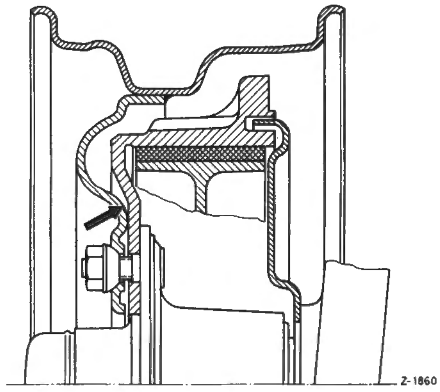


Fig. 42-21/3
2nd version

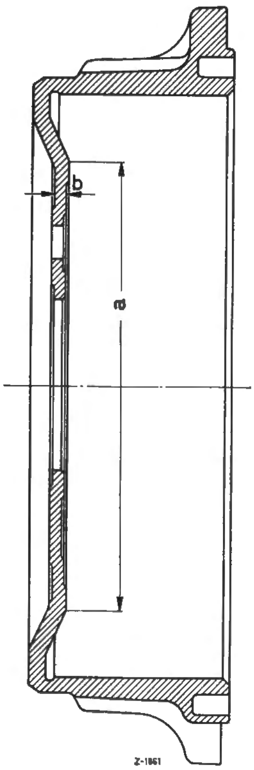


Fig. 42-21/4

Check the run-out of the brake drum at point 'b' (see Job No. 42-0 and Fig. 42-21/4). The run-out should be measured between the two centers of a lathe since measurements are inaccurate when the drum is mounted on the front wheel hub or on the rear axle shaft. If the run-out is excessive the outer face of the brake drum must be reconditioned until the prescribed measure is obtained. Afterwards the braking surface inside the brake drum should be precision turned.

C. Brake Lines and Brake Hoses

1. Brake Hoses of the Front Axle

The brake hoses (7) of the front axle must be fastened to the bracket (1) at the chassis base panel in such a way that they cannot under any circumstances rub against the upper control arms or the tires. When connecting the brake line (3) to the brake hose, always make sure that the

brake hose is not twisted. The position of twisted brake hoses must be corrected by repositioning the hexagon nut on the brake hose in the protection plate (6) (Fig. 42-21/5).

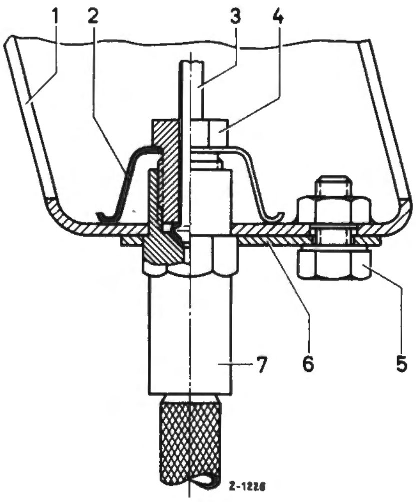


Fig. 42-21/5

1 Bracket at the chassis base panel
2 Brake-hose retainer
3 Brake line
4 Sleeve nut
5 Hexagon nut and spring washer
6 Protection plate
7 Brake hose

When repairs have been carried out following an accident, check the correct position of the brake hoses, since even small changes in the position of the bracket on the chassis base panel may result in the brake hose rubbing against the control arm or the tire. To check this, turn the steering to both right and left full lock, and repeatedly move the front axle half to its highest and lowest position before installing the front springs. On model 300 SL pay attention to the instructions in Job No. 32-11 Section D.

Note: It is a well-known rule that all brake hoses should be replaced after 5 years. When installing new brake hoses please make sure that the brake hoses correspond exactly to the brake system installed in the vehicle.

2. Brake Lines on Axle Tube to Rear Wheel Brakes

The brake line (3) must have a certain minimum distance from the wheel arch in order to ensure that it cannot rub against the wheel arch in any position of the rear axle. The distance from the flange of the rear axle tube to the outer edge of the brake line must be 23 ± 1 mm. Always

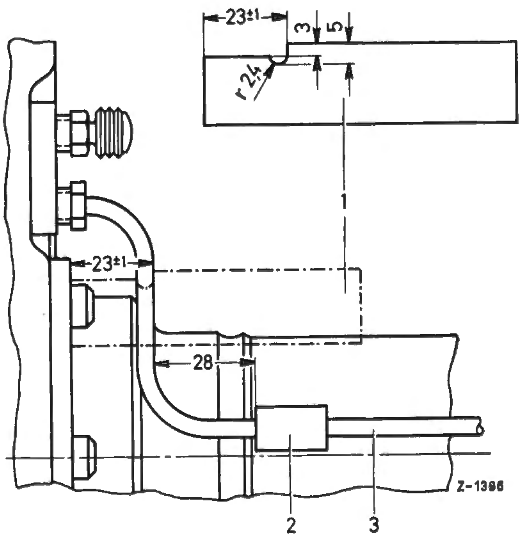


Fig. 42-21/6

1 Gage
2 Rubber ring
3 Brake line

42-21/5

check this distance when repairing a car after an accident. To do this, make a special gage (1), which is the easiest way to check this distance. Furthermore make sure that the rubber rings (2) are properly installed on the brake line, so that the brake line does not touch the axle tube (Fig. 42-21/6).

On recent models the brake lines on the axle tube of the rear axle has been provided with three rubber rings (1). In addition the brake line is fastened to the axle tube by means of a hose strap (2).

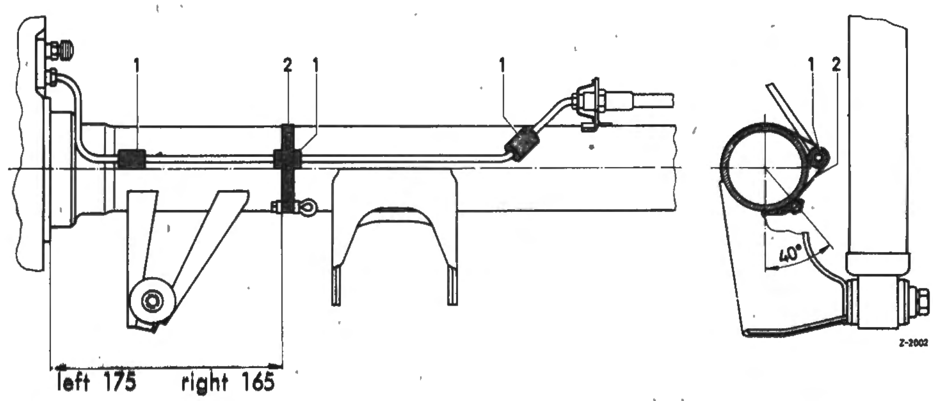


Fig. 42-21/7

1 Rubber ring
2 Hose strap

3. Retaining Angle for the Brake Hoses in Relation to the Rear Wheel Brake on Model 300 SE

A retaining angle (2) has been welded to the chassis base panel (1) left and right and the brake hoses for the rear wheel brakes are attached to these retaining angles. The proper positioning of the brake hoses depends on the proper position of the retaining angles. These angles must not be bent (see dash-dotted line in Fig. 42-12/8). On recent models the retaining angles have been reinforced.

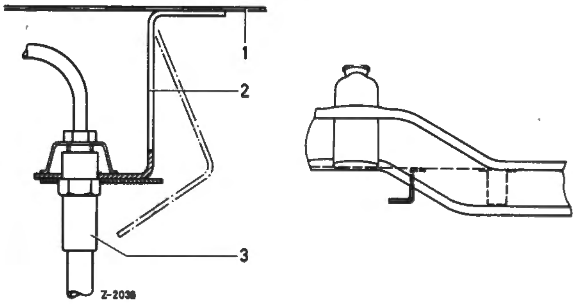


Fig. 42-21/8

1 Chassis base panel
2 Retaining angle
3 Brake hose

4. Brake Line from Master Cylinder to Rear Wheel Brake

The brake line (2) to the rear wheel brake has been laid in such a way that it lies against the side member of the chassis base panel and passes behind the steering coupling. Whenever work is being done on the master cylinder make sure that there is no contact between this line and the steering coupling; as an additional safety measure the pipe clip (4) can be installed slightly underneath the steering (Fig. 42-21/8a).

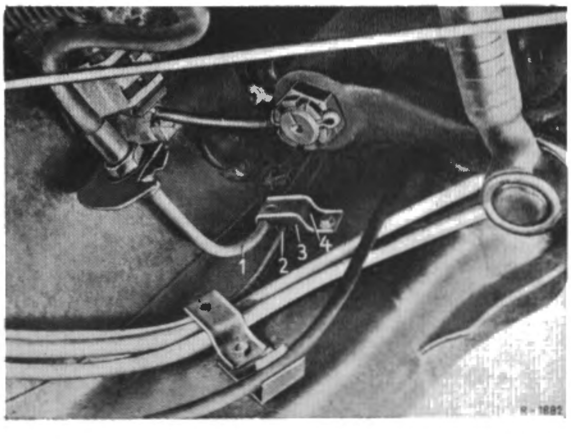


Fig. 42-21/8a

1 Line to extraction cylinder
2 Brake line
3 Rubber cross piece
4 Pipe clip

D. ATE Power Brake T 50

1. Power Brake T 50/24

During the cold season it is common practice to drive for quite some time with the choke control pulled out. As a result, it is practically impossible to prevent fuel drops reaching the rubber check valve Part No. 000 430 08 81. Although the valve is made of gasoline resistant material, it is possible that the surface may be affected by the gasoline, with the result that the valve sticks to the valve seat. When the car is braked for the first time, the valve will not immediately be lifted from its seat, particularly since the pulled-out choke control results in a lower vacuum in the intake pipe. In order to produce a sufficiently high vacuum in such cases, the engine speed must be increased and the accelerator pedal released suddenly. Furthermore, the car should not be driven with the choke control pulled out any longer than is absolutely necessary.

The ball check valve Part No. 000 430 08 81 has been replaced by the plate valve Part No. 000 430 22 81, which shows less tendency to stick. On power brakes with screwed-in check valves the complete plate valve can be installed subsequently, whereas on power brakes with brazed check valves, a threaded union Part No. 111 431 00 75 is required. After removal of the rubber ball the threaded union is screwed into the check valve housing of the power brake and the plate valve is then screwed into the threaded union. Please note that the vacuum hose must be shortened slightly.

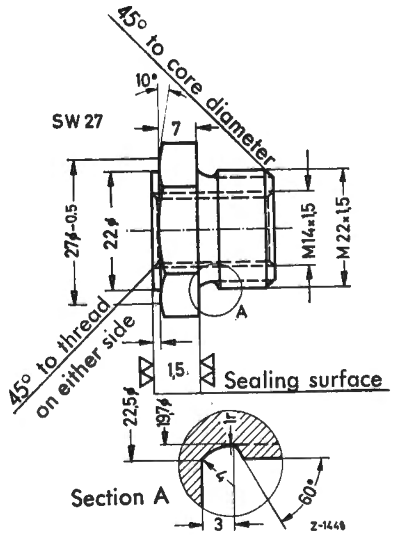


Fig. 42-21/9

Threaded union

2. Gasoline Separating Vessel in Vacuum Line

It may happen under certain circumstances that fuel drops enter the vacuum line between intake pipe and power brake and form a condensate there. Since the power brake is on a level lower than the intake pipe these fuel drops enter the check valve and the power brake and damage or destroy the rubber sleeves. To prevent this, a plastic separating vessel is installed between intake pipe and power brake. The separating vessel which is installed at the lowest point prevents the intrusion of fuel into the check valve or the power brake. Any fuel condensate will be sucked out of the vessel by the engine.

When the separating vessel is installed subsequently take care to ensure that it is installed in a hanging position at the lowest point of the connecting hose. The vacuum hose of the vehicle can be used again after it has been cut in half.

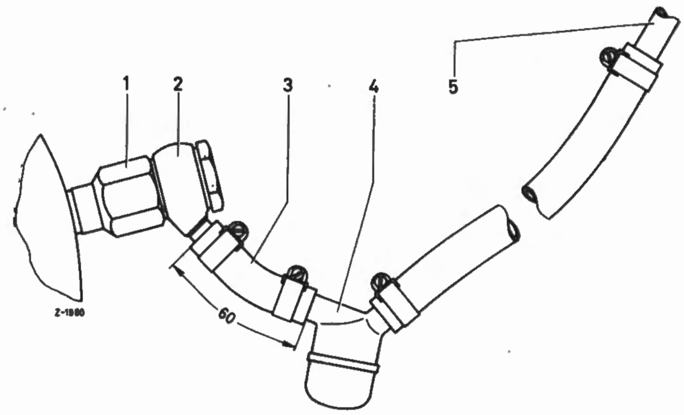


Fig. 42-21/10

Arrangement of ATE Power Brake T 50/24/1 with Gasoline Separating Vessel

1 Check valve
2 Short connecting pipe
3 Vacuum hose
4 Gasoline separating vessel
5 Vacuum line

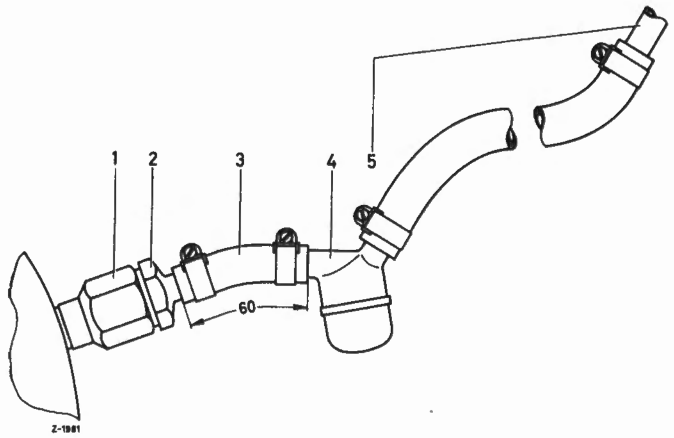


Fig. 42-21/11

Arrangement of ATE Power Brake T 50/26 with Gasoline Separating Vessel

1 Check valve
2 Ring piece
3 Vacuum hose
4 Gasoline separating vessel
5 Vacuum line

E. Leak Check

Whenever work has been done on the hydraulic part of the braking system, a leak check should be made. This leak check consists of three procedures:

1. High pressure leak check
2. Low pressure leak check
3. Primary and residual pressure leak check

High Pressure Leak Check

1. Attach a high pressure gage to a wheel cylinder or to the distributor fitting for the rear wheel brake. To do this, unscrew the bleed screw and screw in the connecting union for the high pressure gage. Bleed the high pressure gage.

Note: Since the bleed screw on the Dunlop brake caliper is sealed by the pressure of a steel ball against the seat of the pressure cylinder, the tester cannot be attached to the pressure cylinder.

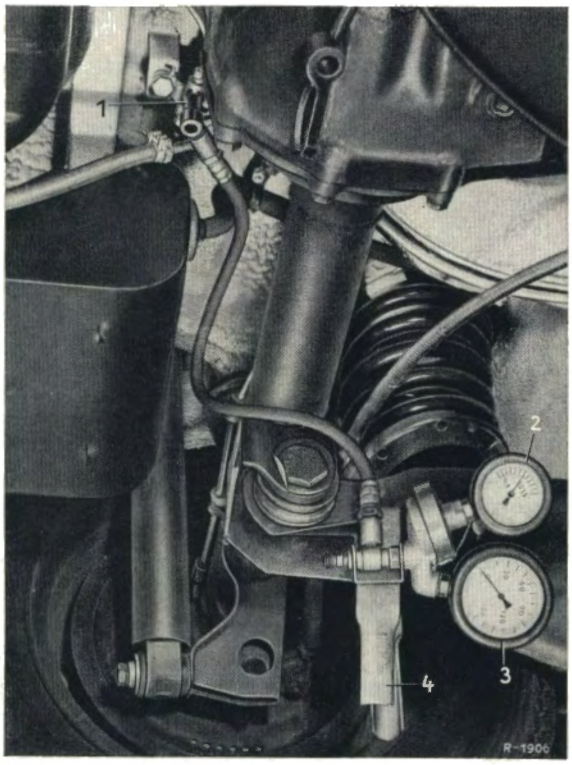


Fig. 42-21/12

1 Distributor fitting
2 Low pressure gage
3 High pressure gage
4 Tester bracket

For the Girling brake caliper 1st and 2nd version, a connecting union with inch thread is not available. The 3rd version brake caliper has a metric thread.

On cars with two-circuit brake system attach one high pressure gage each to the two brake circuits.

2. On cars with ATE power brake run the engine at medium speed and produce maximum vacuum by suddenly releasing the gas pedal.

3. Use the pedal support (1) in order to depress the brake pedal (2) as far as possible to produce the maximum line pressure which should be between 50 and 100 atm. and then fix the brake pedal in this position (Fig. 42-21/13).

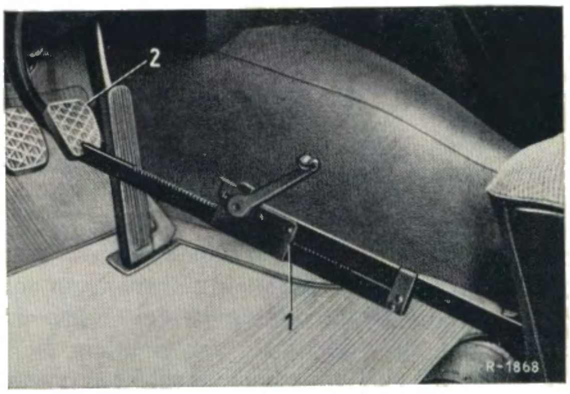


Fig. 42-21/13

1 Pedal support
2 Brake pedal

4. During the testing period, which should be at least 10 minutes, the decrease in pressure should not exceed 10% of the adjusted value. If the decrease is larger, look for the leak and seal it.

Note: On cars with power brake make a second check without vacuum support; in order to do this, switch off the engine and depress the brake pedal approx. 10 times in order to remove the vacuum in the power brake.

Low Pressure Leak Check

1. Move the pedal support back until the pressure gage shows a line pressure of approx. 3 atm.

2. During the testing period of approx. 5 minutes the adjusted pressure must not decrease (brake calipers have a tendency to show a leak under comparatively low pressure).

Primary and Residual Pressure Check

Note: On cars provided with disk brakes on both front and rear axle the hydraulic system has no pressure when the brakes are in the non-applied position.

1. Attach a high pressure tested low pressure gage to a wheel cylinder or to the distributor fitting for the rear wheel brake.

2. Bleed the low pressure gage and depress the brake pedal several times.

3. With the brake released, read off the residual pressure on the pressure gage (see also Job No. 42-0).

Note: The residual pressure must not decrease below the minimum pressure value. If necessary, replace the check valve. According to the brake system employed, the check valve may be arranged as follows:

On cars without a power brake: in the master cylinder.

On cars with power brake T 50/24: in the master cylinder.

On cars with power brake T 50/24/1: in the slave cylinder head. The special check valve installed in the master cylinder has a cone with an axial through-bore.

On cars provided with disk brakes: on the front axle the check valve is arranged in the primary pressure valve for the rear wheel brake. This primary valve maintains the residual pressure only for the drum brake on the rear axle.

On cars with two-circuit brake system and tandem master cylinder 1st version: on the front connecting union of the tandem master cylinder. The hexagon is bonderized. The rear connecting union (to the front wheel brake) has a special check valve and is cadmium-plated.

On cars with two-circuit brake system and tandem master cylinder 2nd and 3rd version: on the rear connecting union. The connecting union is bonderized.

F. Uneven Brake Action on Cars with Disk Brakes

Uneven brake action may be due to defects in the brake system; it can also be caused by tire wear and by varying road conditions. There is an important difference between brake dragging on wet roads and on dry roads. On wet roads slight brake dragging is unavoidable since splash will affect the left and right brakes differently and tire grip on the road surface is bound to be uneven. Brake action can therefore only be judged when the brakes are dry.

Before and during the brake test make the following checks:

a) Check and correct the tire pressure. Check the tire tread; unevenly worn tires and different tire makes will produce differing frictional contact with the road surface. Furthermore brake tests should always be made with standard tires and never with special purpose tires.

b) Check whether the car runs straight ahead when the brakes are not applied. If this is not the case check and correct all wheel adjustment values.

If brake dragging persists, proceed as follows:

Disconnect the brake line to the rear wheel brake and close the union with a dummy plug. Check the road holding of the car on a trial run. If uneven dragging has disappeared the fault was in the rear axle.

Possible sources:

Inadequate wear pattern of the brake linings, brake linings not released by our Service Organization and with friction values out of harmony with the disk brake friction pads. If none of these faults is discovered, 20 mm of the lining of the leading brake shoes can be sawn off with a sharp edge, but this procedure is not recommended as a general remedy.

If uneven brake action persists although the rear wheel brake has been disconnected, the disk brake is responsible and the following checks should be made:

Brake Calipers

Jack up the front of the car and check whether the two wheels turn evenly. If this is not the case the cause may be as follows:

Dunlop brake caliper: automatic adjustment not functioning properly: replace the pressure cylinder. Caliper gap heavily corroded or fouled. Friction pad installed incorrectly.

Teves or Girling brake caliper: piston binding in pressure cylinder (Remedy see Job No. 42-12).

Girling brake caliper: heat screening plates dented. (Remedy: replace heat screening plate).

Note: If the two wheels turn unevenly there may be a fault in the special check valve which produces a residual pressure in the hydraulic system. If this is the case replace the special check valve.

Friction Pads

Remove the friction pads and inspect the wear pattern of the linings. The surface of the linings must be the same on all friction pads. Linings with better brake action have a rough, porous surface, whereas linings with less effective brake action have a smooth, shiny surface. In accordance with the wear pattern the friction pads should be installed in such a way that each brake caliper is provided with one rough-surface and one smooth-surface friction pad.

Brake Disks

Scores along the circumference of no more than 0.5 mm depth have no influence on even brake action. When brake disks are dirty with grey or black-blue deposits they must be reconditioned by means of cleaning pads (see Job No. 42-11a).

G. Squeaking Brakes

On cars with disk brakes, squeaking occurs mainly when the brakes are applied lightly and usually disappears with higher brake pedal pressure. On new cars or with new friction pads, brake squeaking decreases after a few hundred miles.

Slight squeaking, which to some extent depends on weather conditions anyway, is unavoidable. If squeaking is excessive the following remedies are available:

a) Check the clearance between the lateral faces of the friction pads and the brake caliper gap. On Teves and Girling calipers the clearance should be 0.1–0.2 mm.

b) Rub the lateral and rear faces of the friction pads with Molykote Paste "U".
Caution: The paste must on no account contaminate the breaking areas.

c) In the case of Girling brake calipers check the heat screening plates and if necessary replace them; they should never be dented.

H. Testing the Power Brake

The T 51 power brakes can be tested without removing them from the car. The following instruments are required:

1. Vacuum gage
2. High pressure gage (e. g. Testometer)
3. Dynamometer

Connect the vacuum gage to the vacuum line between intake manifold and power brake, on Diesel engine cars to the vacuum line between vacuum pump and power brake, and in cars with a 2nd version power brake with separate check valve at a point behind the check valve. Connect the high-pressure gage to one of the brake calipers to measure the pressure in the brake lines. Measure the brake-pedal pressure by means of a dynamometer or a pressure-operated spring scale.

The test can only be carried out when the vacuum is between 0.7 and 0.8 kg/sq. cm. If necessary the required vacuum can be produced on gasoline engine cars by accelerating the engine and suddenly releasing the gas pedal.

If the vacuum is considerably below the prescribed value or if it drops immediately, the following defects may be responsible:

1. Leaks in the vacuum line or in the connections.
2. Check valve not working properly.
3. Damaged O-ring between power brake and tandem master cylinder.
4. Damaged vacuum seals in tandem master cylinder, so that outside air can enter the vacuum cylinder via the leak oil bore in the master cylinder.
5. Damaged sealing ring in the control housing of the power brake. The sealing ring cannot be replaced with the tools available in the workshop and the power brake must be replaced.
6. Damaged vacuum pump on diesel engine cars.
7. Throttle valve not fully closed at idling speed on cars with gasoline injection engine.

The brake line pressure listed in Job No. 42-0 must be reached when the power brake is functioning properly.

Note: It happens frequently that repairshops replace the power brake when the customer complains about insufficient brake action. In our experience the fault lies very often with the insufficient friction of the friction pads. The power brake should therefore never be removed before it has been thoroughly tested in the car.

Replacement and Resurfacing of Brake Linings

Job No.
42-22

A. Replacement of Brake Linings

1. If the brake linings are worn down to a thickness of approx. 1.5 mm, they must be replaced. In our workshops the brake linings are bonded to the brake shoes without riveting in a special process under pressure and at a temperature of 160—180° C. To make sure that the bonding is completely satisfactory, a small corner is cut off every brake lining to make a shearing test. The bonding of the brake linings requires much experience and expert knowledge and is not possible with the equipment available in repair shops. For this reason only brake linings bonded to brake shoes are supplied by way of exchange.

2. If in countries outside Germany it should be difficult to import brake shoe assemblies, it is possible to use special linings that can be riveted to the brake shoes. Completely remove the old lining, together with the cement, from the brake shoes (grind off the lining or, if necessary, chisel or file it off). After the surface of the brake shoes has been thoroughly cleaned of all traces of cement, the brake linings and the brake shoes must be drilled according to the drillhole digram below. If the brake linings are already provided with rivet holes, the drillhole pattern is transferred to the brake shoes and holes are drilled accordingly (Fig. 42-22/1).

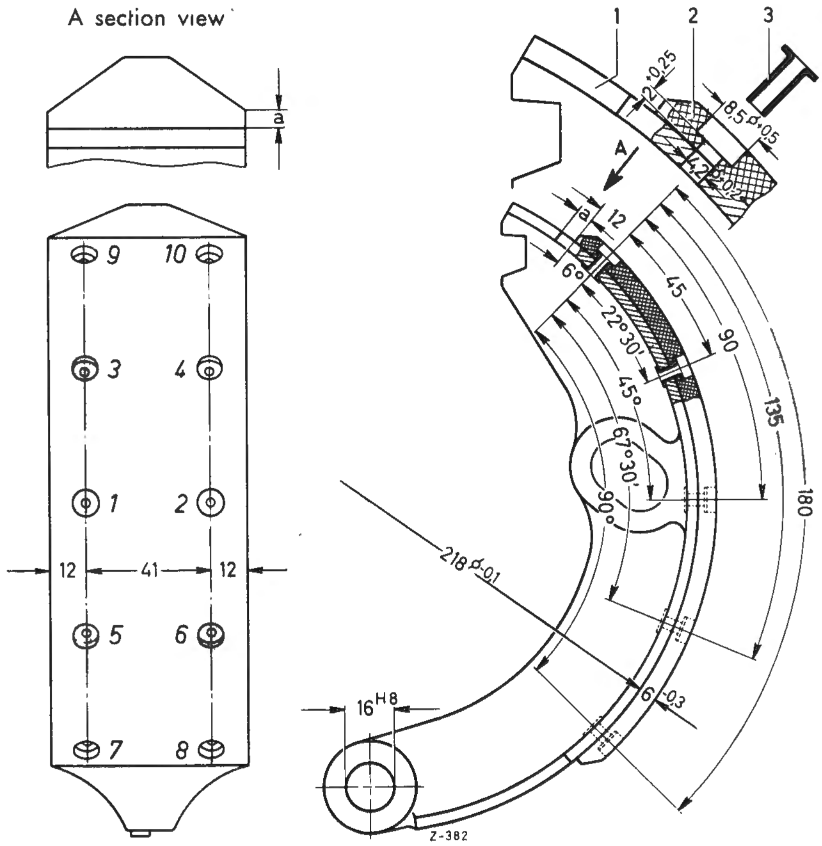


Fig. 42-22/1

Core location diagram for 65 mm brake shoes

1 Brake shoes	a = Distance between brake lining and toe edge
2 Brake lining	at rear brake shoe = 2 mm
3 Tubular rivet	at front brake shoe = 4 mm

42-22/1

Note: The medium center distance between the holes on the 50 mm brake shoes of the 1st version rear wheel brake on Model 220 b is 32 instead of 41 mm and the lateral distance is 9 instead of 12 mm.

Coat the brake shoe surface with sealing compound and rivet the brake lining to the shoe by means of tubular rivets (3) Part No. 183 990 02 95.

The riveting sequence is shown in Fig. 42-22/1. Start in the middle of the lining 1, then install the rivets 2,3 etc. This procedure is necessary in order to make sure that the brake lining snugly fits the whole surface of the brake shoe.

Use only the brake linings approved by our works.

When riveting the brake linings to the light metal brake shoes on the rear wheel brake, please note the following: after drilling the holes, use a 4×8.5 mm ⌀ shank cutter to mill holes nos. 1, 2, 9, and 10 (Fig. 42-22/2) in the web and the shoe reinforcement down to the standard brake shoe thickness of 5 mm so that tubular rivet Part No. 183 990 02 95 can be used for all bores.

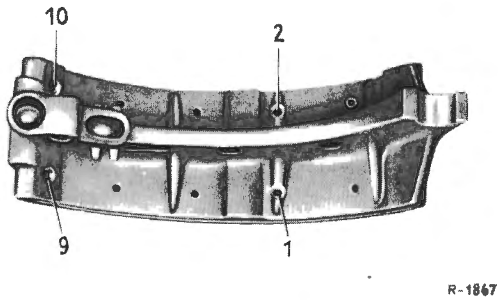


Fig. 42-22/2

B. Reconditioning of Brake Linings

The brake linings must be reconditioned if the surface shows glazed spots or signs of overheating, or if the wear pattern of the linings is unsatisfactory.

1. Reconditioning with sandblasted brake drums

The best method of reconditioning brake shoes is the use of sandblasted brake drums. The brake drums should be lightly sandblasted with a medium-size grain. If a special set of sandblasted brake drums is not available, the drums of the car to be repaired can be used since such lightly sandblasted brake drums loose their roughness after a few brake operations. The brake should then be worn in on a trial run by carefully applying the brakes several times.

Note: Soft brake linings. e. g. Johns-Manville linings cannot be reconditioned by means of sandblasted brake drums since the roughness of the brake drums would produce scores in the brake lining even when the brakes are applied very carefully.

2. Reconditioning with precision-turned brake drums

Soft brake linings are reconditioned by means of precision-turned brake drums. The roughness produced by the turning operation is sufficient to obtain a satisfactory wear pattern on the brake linings even after a few braking operations.

3. Reconditioning with the Zanchi turning attachment

The Zanchi turning attachment can be used for both soft and hard brake linings. If the attachment is used properly, a good wear pattern of the brake linings can be obtained.

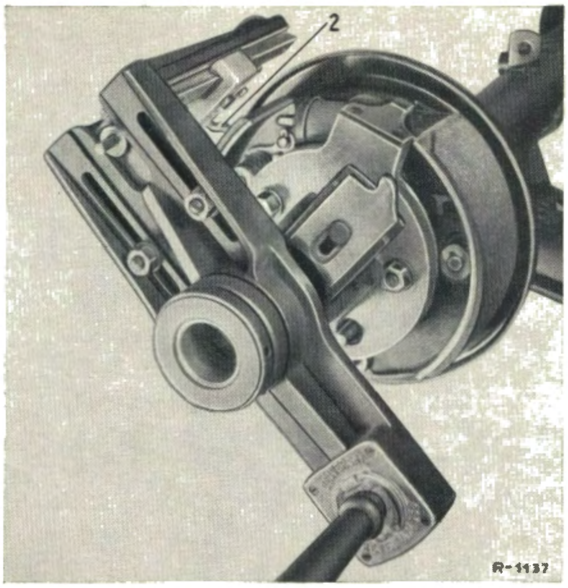


Fig. 42-22/3

2 Turning tool

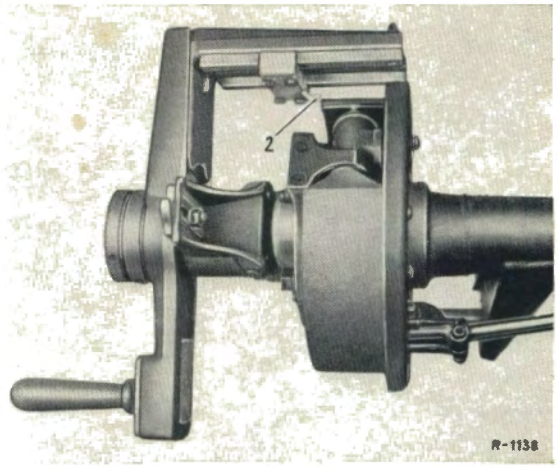


Fig. 42-22/5

2 Turning tool

If the Zanchi turning attachment is used the following points need attention:

1. On all models with automatic brake shoe adjustment vigorously depress the brake pedal so that the brake shoes are adjusted properly by the automatic adjustment device. Then use the turning tool of the attachment to find the highest spot on the brake lining and fix the turning tool in this position.

2. On models with mechanical brake shoe adjustment, measure the diameter of the brake drum with the gage (3) and install the gage in the turning attachment (1). When the turning tool (2) has been adjusted to the diameter of the gage, turn the adjusting screw toward the left approx. 1/6 turn. This adjustment will provide the diameter to which the brake shoes should be returned.

3. Re-turn the brake linings by removing as little stock as possible (0.1 to 0.2 mm). After adjusting the brake shoes, the operation must be repeated as often as necessary until the whole lining surface has been reconditioned.

Note: The front wheel hub must not have excessive play, since this would make proper re-turning of the brake linings impossible.

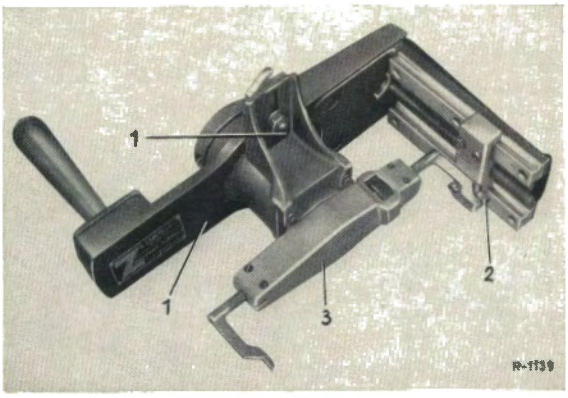


Fig. 42-22/4

1 Turning attachment
2 Turning tool
3 Gage

Bleeding of the Brake System

Job No.
42-23

The brake system must be bled whenever the closed hydraulic system is opened during repairs or when the brake pedal is soft and spongy. Various types of special bleeding equipment are available such as the ARC 50 pressure bleeder or the ATE filler and bleeder. Carefully observe the manufacturers' instructions when using this special equipment.

The brake fluid removed during the bleeding operation must be discarded since it may contain foreign particles that must be prevented from getting into the hydraulic system. Another important consideration is that in the course of time the highly hygroscopic brake fluid constantly absorbs moisture from the atmosphere and its boiling point decreases. As a result vapor bubbles may form in the brake system under extreme conditions, in particular in cars with disk brakes.

The brake fluid contains constituents that act as a solvent on the car finish and should therefore never be allowed to come into contact with the car finish.

The bleeding process is finished when clear bubble-free brake fluid emerges from the bleeder hose.

After bleeding the fluid reservoir should be filled with brake fluid up to the mark "maximum".

Note: When the brake system is bled by "pumping" the brake pedal, always close the appropriate bleed screw to make sure that air cannot be drawn in via the bleed screw thread.

Sequence of Bleeding Operations:

1. On Cars with One-Circuit Brake System

a) **On cars with drum brakes and cars with disk brakes on both front and rear axles**

First bleed the master cylinder, then the power brake (if installed) and then start with the bleeding point farthest from the main cylinder, which as a rule will be the right rear wheel.

b) **On cars with a combined drum and disk brake system**

First bleed the master cylinder and the power brake and then proceed to the brake caliper farthest from the master cylinder. Bleed the second brake caliper and bleed the drum brakes by starting at the bleeding point farthest from the master cylinder.

2. On Cars with Two-Circuit Brake System

If both circuits have been opened, first bleed the circuit connected to the push rod space and then the circuit connected to the floating space. If only one circuit has been opened, only bleed this circuit.

Job No.
42-25

Removal and Installation of Hand Brake Caliper

Removal:

1. Unscrew the bracket (35) of the brake cable (39) from the lever (41) of the brake support (Fig. 42-25/1).

2. Detach the leg spring (26) from the fitting plate of the friction pad (29) (Fig. 42-25/1).

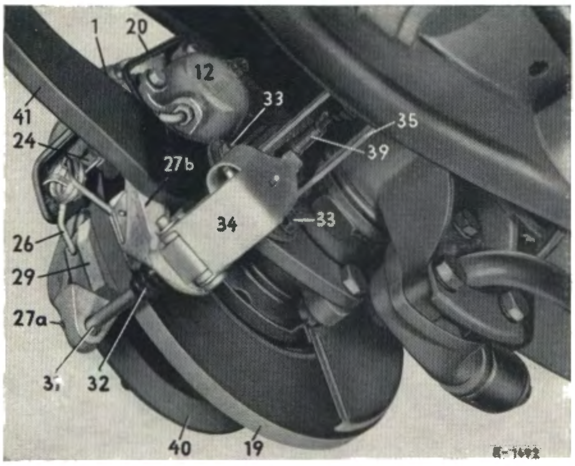


Fig. 42-25/1

View of the brake caliper from inside

1	Brake caliper	31	Adjustment screw
12	Pressure cylinder	32	Rubber grommet
19	Brake disk	33	Hexagon screw with lock washer
20	Connecting line	34	Tension lever
24	Locking plate	35	Rear brake cable bracket
26	Leg spring	39	Rear brake cable
27a	Outer lining carrier	40	Wheel fixing disk
27b	Inner lining carrier	41	Brake support lever
29	Friction pad (hand brake)		

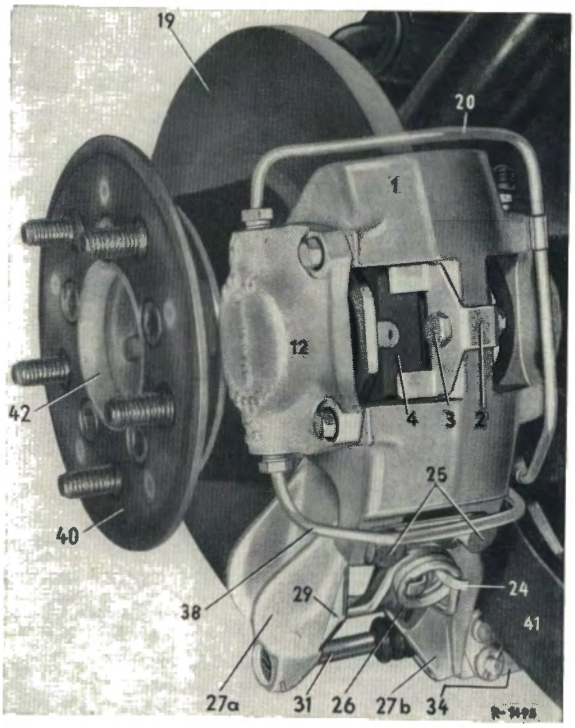


Fig. 42-25/2

View of the brake caliper from outside

1	Brake caliper	25	Swing bolt
2	Stirrup	26	Leg spring
3	Hexagon screw with hexagon nut and serrated lock washer	27a	Outer lining carrier
		27b	Inner lining carrier
4	Friction pad with fitting plate (service brake)	29	Friction pad with fitting plate (hand brake)
12	Pressure cylinder	31	Adjustment screw
19	Brake disk	34	Tension lever
20	Connecting line with pipe clip	38	Brake line
		40	Wheel fixing disk
		41	Brake support lever
24	Locking plate	42	Rear axle shaft

3. Tap up the locking plate (24) and unscrew the swing bolt (25) (Fig. 42-25/1).

4. Remove the hand brake caliper and detach the brake cable from the tension lever.

Installation:

5. Clean the recess for the lining carrier in the brake caliper. Coat the contact points and the swing bolt with Molycote Paste Type 'G'.

6. Put a new locking plate (24) on the swing bolt (25) (Fig. 42-25/1).

7. Attach the brake cable to the tension lever. Insert the hand brake caliper in the brake caliper, screw in the swing bolt and tigthen with the prescribed torque (see Job No. 42-0).

8. **Check whether the lining carriers swivel easily on the swing bolt. Cotter the swing bolt.**

9. Put the leg spring on the locking plate and bend the lug of the locking plate in such a way that there is a clearance of approx. 1.0 mm between the upper spring coil and the lug.

10. Attach the legs of the spring in the fitting plate of the friction pads.

11. Attach the bracket to the brake support lever.

12. Check the hand brake.

Removal and Installation of Automatic Hand Brake Adjustment on the Dunlop Brake Caliper

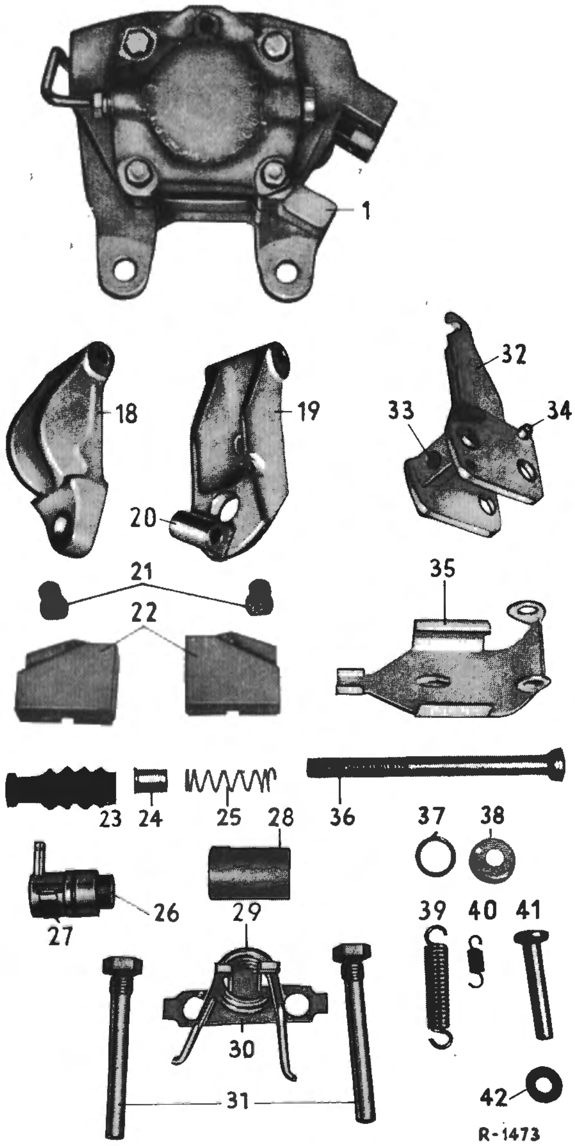


Fig. 42-27/1

1 Brake caliper
18 Outer lining carrier
19 Inner lining carrier
20 Bearing bracket for tension lever
21 Cheese-head screw with hexagon nut and toothed washer
22 Friction pad with fitting plate
23 Rubber grommet
24 Plastic bushing
25 Pressure spring
26 Automatic adjustment
27 Flat spring
28 Rubber grommet
29 Leg spring
30 Locking plate
31 Swing bolt
32 Tension lever
33 Driving block
34 Pin on tension lever
35 Cover plate
36 Adjustment screw
37 Retaining spring
38 Cup
39 Return spring
40 Return spring
41 Collar bolt
42 Washer

Removal:

1. Remove the hand brake caliper (see Job No. 42-25).

2. Pull the cotter (43) which secures the adjustment screw (36) out of the outer lining carrier (18) and unscrew the adjustment screw from the automatic adjustment (Fig. 42-27/3).

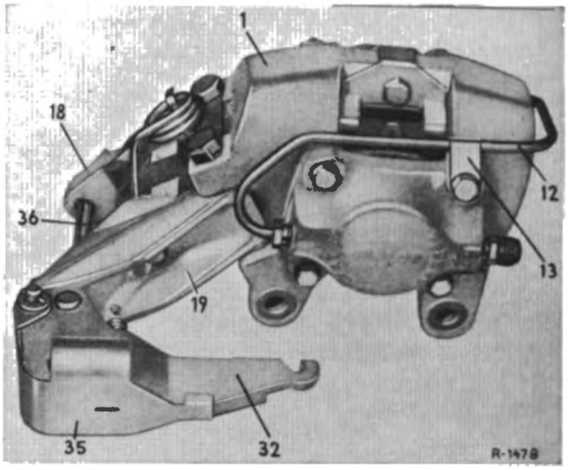


Fig. 42-27/2

1 Brake caliper
12 Connecting line
13 Pipe clip
18 Outer lining carrier
18 Inner lining carrier
32 Tension lever
35 Cover plate
36 Adjustment screw

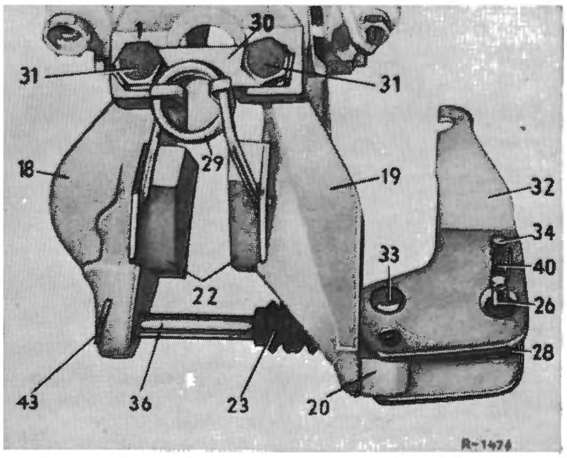


Fig. 42-27/3

1 Brake caliper
18 Outer lining carrier
19 Inner lining carrier
20 Bearing bracket for tension lever
22 Friction pad with fitting plate
23 Rubber grommet
26 Adjusting finger on automatic adjustment
28 Rubber grommet
29 Leg spring
30 Locking plate
31 Swing bolt
32 Tension lever
33 Driving block
34 Pin on tension lever
36 Adjustment screw
40 Return spring
43 Cotter pin

3. Remove the rubber grommet (23) together with plastic bushing (24) and pressure spring (25) from the adjustment screw (36) (Figs. 42-27/1 and 42-27/3).

4. Detach the return spring (39) from the inner lining carrier (19) and the cover plate (35) (Fig. 42-27/4).

5. Pull the cotter pin out of the collar bolt. Remove the washer and tap out the collar bolt (Fig. 42-27/2).

6. Take off the tension lever (32) from the inner lining carrier (19) and remove the cover plate (35) from the tension lever (Fig. 42-27/2).

7. Detach the return spring (40) from the adjusting finger of the automatic adjustment (26) and from the pin (34) of the tension lever (32) (Fig. 42-27/3).

8. Remove the automatic adjustment (26) from the tension lever (32). To do this, swivel the automatic adjustment together with the driving block out of the tension lever toward the back so that the leg of the retaining spring (37) jumps out of the bore in the driving block. Turn the driving block back and tilt the automatic adjustment until the adjusting finger can be removed from the bore in the tension lever (Fig. 42-27/1).

9. Remove the rubber grommet (28) from the automatic adjustment (26) (Fig. 42-27/1).

10. Remove the cup (38) and the retaining spring (37) from the shank of the adjusting nut (26) (Fig. 42-27/1).

Checking:

11. Check the ratchet arrangement in the automatic adjustment (26). The adjusting nut in the automatic adjustment, when turned toward the left, should make an audible ratchet noise whereas it should lock when turned toward the right.

12. Check the flat spring (27) on the automatic adjustment (26). If the spring should be partly broken, the complete adjustment system should be replaced (Fig. 42-27/1).

13. Check the retaining spring (37) on the collar of the adjusting nut of the automatic adjustment (26) (Fig. 42-27/1).

Note: The retaining spring prevents the adjusting nut from turning when the adjustment screw is backed out. It is for this reason that the retaining spring must not slip when it is turned clockwise on the collar of the adjusting nut. If the retaining spring should slip, it should be replaced by a spring with a smaller inside diameter.

14. Check the driving block (33) in the tension lever (32) for ease of movement (Fig. 42-27/1).

Installation:

15. Carefully clean the automatic adjustment (26) and coat the adjusting nut and the adjusting sleeve with a water-resistant grease. Pull a new rubber grommet (28) over the automatic adjustment (Fig. 42-27/1).

16. Install the retaining spring (37) in the cup (38) (Fig. 42-27/1).

17. Put the cup together with the retaining spring on the driving block (33) of the tension lever (32) making sure that the leg of the retaining spring engages the hole in the driving block (Fig. 42-27/1).

18. Insert the automatic adjustment (26) in the tension lever (32) in such a way that the collar of the adjusting nut completely engages the retaining spring. Then guide the adjusting finger of the automatic adjustment through the tension lever (Fig. 42-27/1).

Note: The finger must be guided through the tension lever on the side on which the pin is located.

19. Clean the thread of the adjustment screw (36), coat it with Molycote Paste and slide it through the outer lining carrier (18). Install a new rubber grommet (23) together with the plastic bushing (24) and the pressure spring (25) on the adjustment screw. Then insert the adjustment screw in the inner lining carrier (19) (Fig. 42-27/1).

20. Put the tension lever (32) on the bearing bracket (20) of the inner lining carrier (19) and screw the adjustment screw (36) several turns into the automatic adjustment (26) (Fig. 42-27/1).

21. Push the rubber grommet (23) together with the plastic bushing (24) trough the bore in the inner lining carrier (19) as far as at will go (Fig. 42-27/4).

22. Attach the leg spring (29) to both friction pads (22).

23. Attach the return spring (40) to the finger (26) of the automatic adjustment and the pin (34) of the tension lever (32) (Fig. 42-27/3).

25. Attach the return spring (39) to the cover plate (35). Push the tension lever (32) toward the inner lining carrier (19) and attach the return spring to the lining carrier (Fig. 42-27/4).

26. Back out the adjustment screw (36) until there is a distance of approx. 0.5 mm between the brake disk and the friction pads. Then cotter the adjustment screw (Fig. 42-27/3).

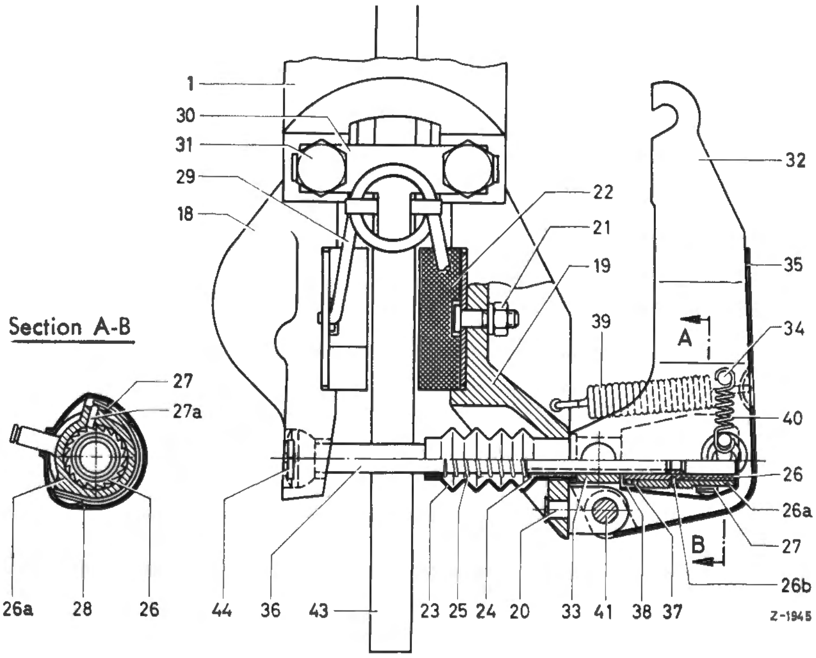


Fig. 42-27/4

1 Brake caliper
18 Outer lining carrier
19 Inner lining carrier
30 Bearing bracket
21 Cheese-head screw with hexagon nut and toothed washer
22 Friction pad with fitting plate
23 Rubber grommet
24 Plastic housing
25 Pressure spring
26 Adjusting nut
26a Adjusting sleeve
26b Snap ring
27 Flat spring
27a Pin
28 Rubber grommet
29 Leg spring
30 Locking plate
31 Swing bolt
32 Tension lever
33 Driving block
34 Pin on tension lever
35 Cover plate
36 Adjustment screw
37 Retaining spring
38 Cup
39 Return spring
40 Return spring
41 Collar bolt
43 Brake disk
44 Cotter pin

24. Slide the cover plate (35) over the tension lever (32). Coat the collar bolt (41) with Molycote Paste. Rest the tension lever with collar bolt against the inner lining carrier (19), put on the washer (42) and cotter the collar bolt (Fig. 42-27/1).

Note: The cotter pin (43) prevents the adjustment screw (36) from turning during the adjusting process (Fig. 42-27/3).

27. Install the hand brake caliper (see Job No. 42-25).

28. Check the function of the hand brake.

Removal and Installation of Duo Servo Parking Brake

Job. No.
42-28

Removal:

1. Remove the brake caliper (see Job No. 42-2).

2. Remove the brake disk. It is advisable to mark the relative position of brake disk and rear axle shaft in order to ensure that the brake disk is reinstalled in the same position.

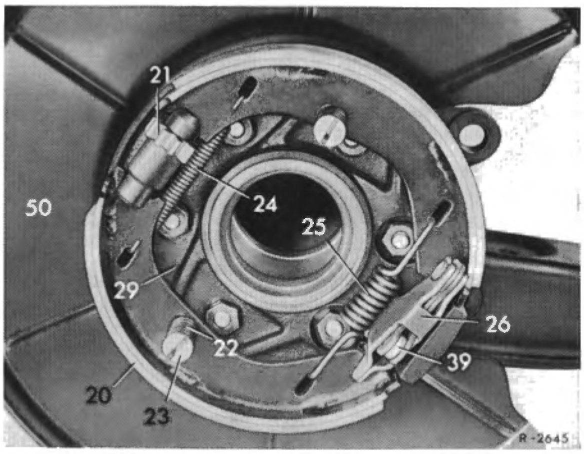


Fig. 42-28/1

20 Brake shoe
21 Readjustment device
22 Pressure spring
23 Retaining pin
24 Upper return spring
25 Lower return spring
26 Expansion lock
29 Back plate
39 Brake cable
50 Cover plate

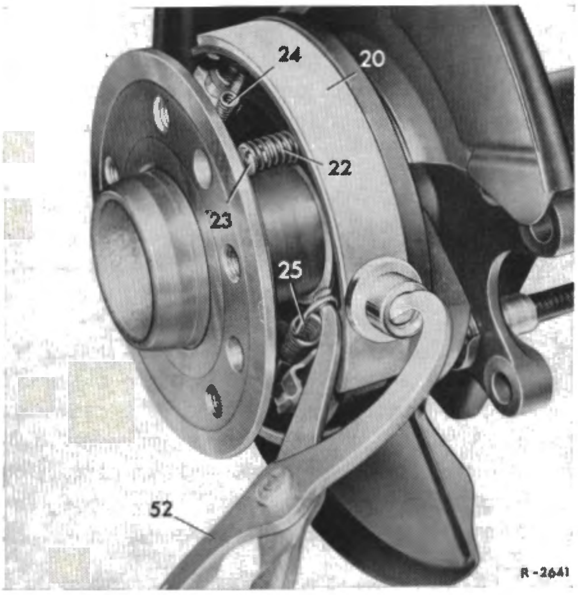


Fig. 42-28/2

20 Brake shoe
22 Pressure spring
23 Retaining pin
24 Upper return spring
25 Lower return spring
52 Brake spring pliers

3. Unhook the lower spring (25) by means of the brake spring pliers (52) (Fig. 42-28/2).

4. Turn the rear axle shaft (40) until the large assembly hole (40a) in the rear axle shaft points toward one of the retaining pins (33). Compress the pressure spring (22) with a hexagon socket wrench, turn the retaining pin 90° and remove the spring together with the retaining spring through the assembly hole in the rear axle shaft (Fig. 42-28/3).

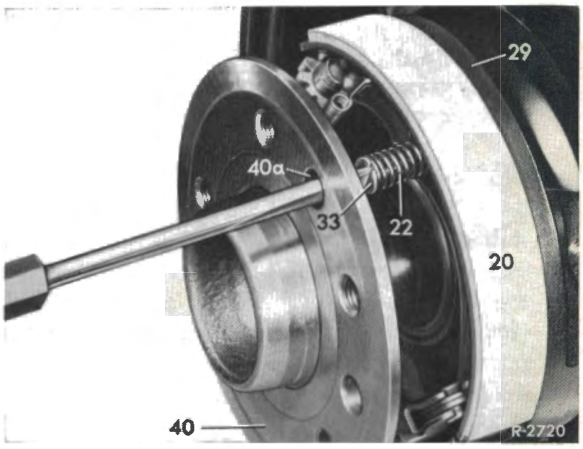


Fig. 42-28/3

20 Brake shoe
22 Pressure spring
29 Back plate
33 Retaining pin
40 Rear axle shaft
40a Assembly hole in the rear axle shaft

5. Remove the pressure spring and the retaining pin from the second brake shoe (see para 4).

Note: The 1st version retaining pin was slotted; in the present version it was a SW 6 mm hexagon socket.

6. Pull the two brake shoes (20) apart at their lower end so that they can be removed over the rear axle shaft (40) (Fig. 42-28/8).

7. Unhook the upper return spring (24) from the brake shoe (20) and remove the readjustment device (21) (Fig. 42-28/4).

8. Unhook the return spring (2) from the equaliser (3), turn the wing nut (8) back as far as it will go and detach both brake cables (1) from the equaliser (see Fig. 42-19/2).

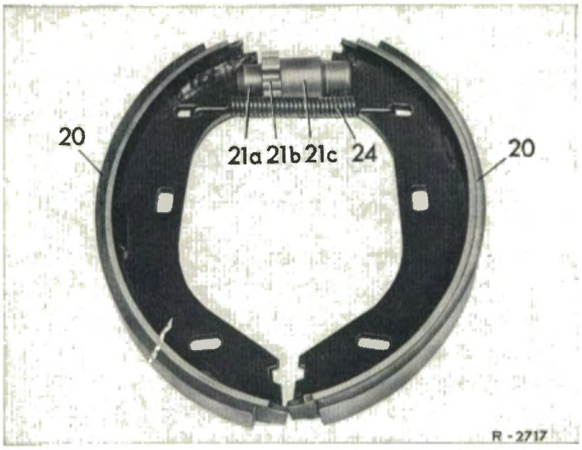


Fig. 42-28/4

20 Brake shoes
21 a Pressure block
21 b Toothed adjustment wheel
21 c Pressure sleeve
24 Upper return spring

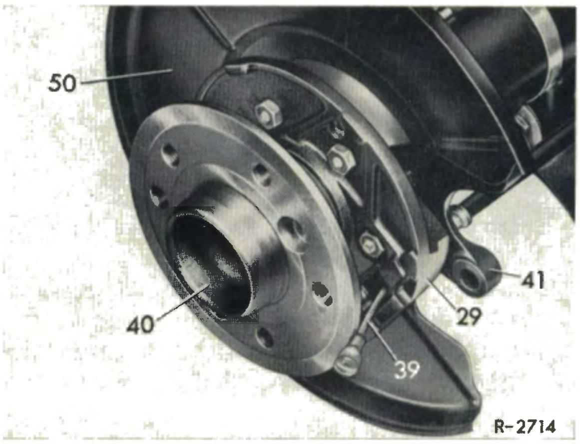


Fig. 42-28/6

29 Back plate
39 Brake cable
40 Rear axle shaft
41 Bearer tube
50 Cover plate

9. Press the pin (33) out of the expansion lock (36) and remove the expansion lock from the brake cable (39) (Fig. 42-28/7).

Installation:

10. Rub all bearing and sliding surfaces of the expansion lock with Molycote paste. Attach the brake cable (39) to the expansion lock (26) by means of the pin (33). Press the expansion lock into the back plate (29) (Figs. 42-28/5 to 7).

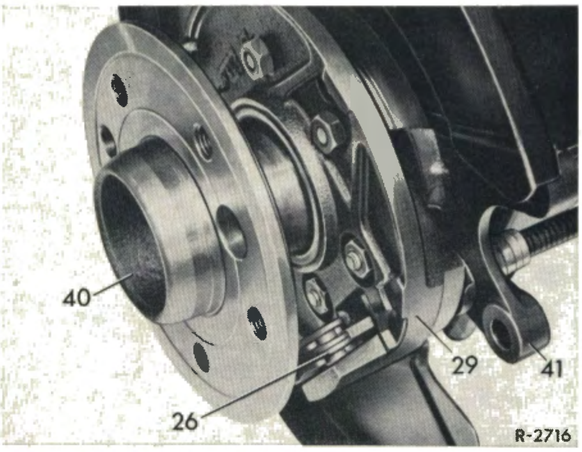


Fig. 42-28/5

26 Expansion lock
29 Back plate
40 Rear axle shaft
41 Bearer tube

11. Attach the brake cables and the return spring to the equaliser.

12. Turn the readjustment device back as far as it will go taking care to ensure that the toothed adjustment wheel moves freely on the pressure block; if necessary coat with Molycote paste.

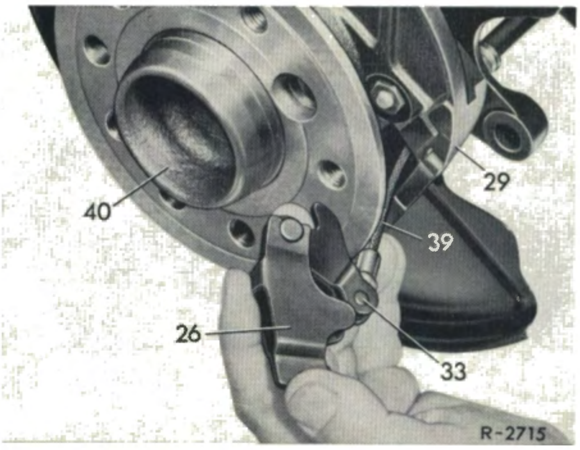


Fig. 42-28/7

26 Expansion lock
29 Back plate
33 Brake cable pin
39 Brake cable
40 Rear axle shaft

13. Install the readjustment device (21) in the two brake shoes in such a way that the toothed adjustment wheel points forward. Attach the upper return spring (24) to the brake shoes (20) from the rear (Fig. 42-28/4).

14. Pull the brake shoes (20) apart at their lower end, slide them in over the rear axle shaft (40) and install them in the expansion lock (Fig. 42-28/8).

15. Install the two pressure springs (22) and the retaining spring (23) in the back plate (29) through the assembly hole in the rear axle shaft (40). Turn the retaining pins 90°, taking care to ensure that the retaining pins become properly seated in the spring retainer (29a) of the back plate (29) (Figs. 42-28/9 and 10).

16. Attach the lower return spring (25) to the rear brake shoe (20) with the small eye and use the brake spring pliers (52) to attach it to the front brake shoe (Fig. 42-28/2).

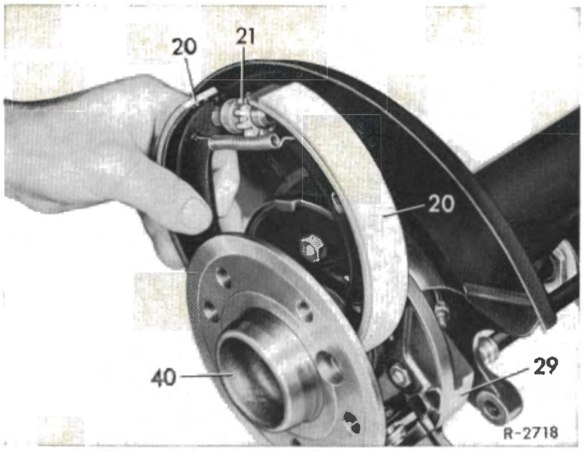


Fig. 42-28/8

20 Brake shoe
21 Readjustment device
29 Back plate
40 Rear axle shaft

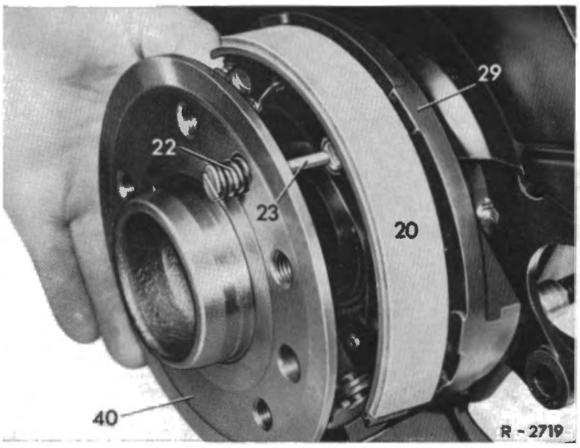


Fig. 42-28/9

20 Brake shoe
22 Pressure spring
23 Retaining pin
29 Back plate
40 Rear axle shaft

17. Slide on the brake disk and install the brake caliper. Check the brake system for leaks.

18. Adjust the parking brake (see Job No. 42-20, Section F).

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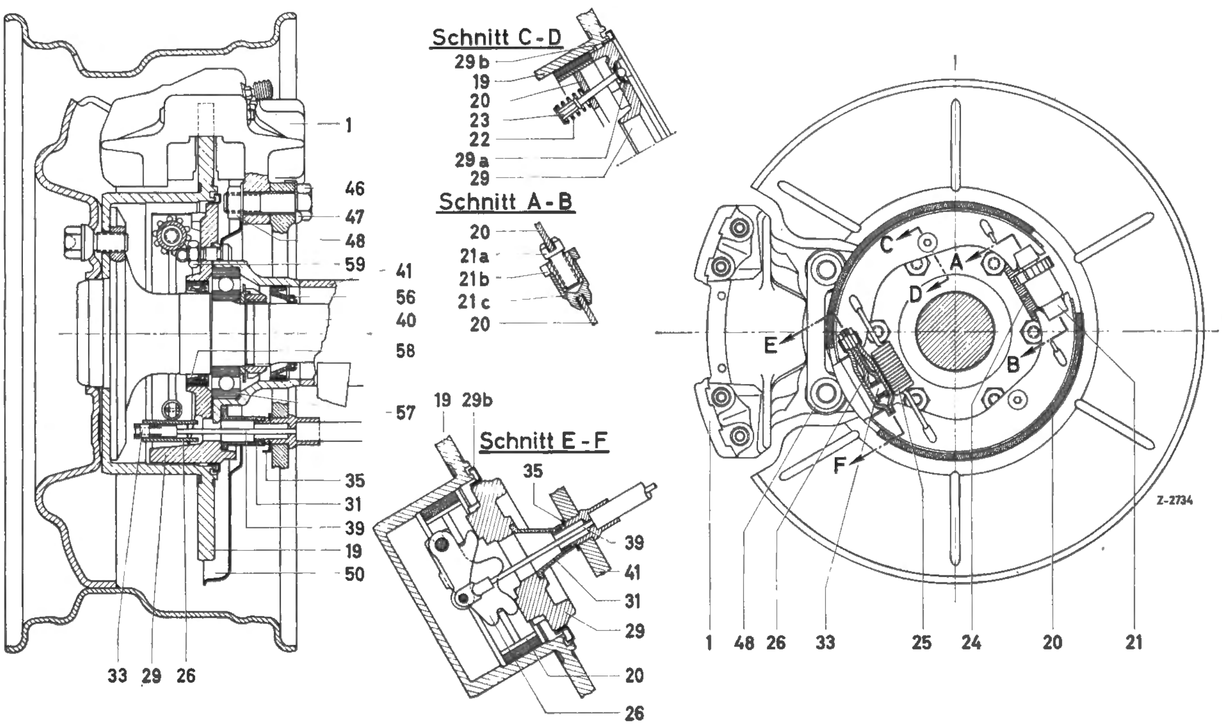


Fig. 42-28/10

1	Brake caliper	23	Retaining pin	33	Brake cable pin	48	Bracket with weld-on nut
19	Brake disk	24	Upper return spring	35	KL lock for brake cable	50	Cover plate
20	Brake shoe	25	Lower return spring	39	Brake cable	56	Sealing ring
21	Readjustment device	26	Expansion lock	40	Rear axle shaft	57	Grooved annular bearing
21 a	Pressure block	29	Back plate	41	Bearer tube	58	Sealing ring
21 b	Toothed adjustment wheel	29 a	Spring retainer	46	Hexagon fitting screw	59	Fitting screw with lock washer and hexagon nut
21 c	Pressure sleeve	29 b	Screening plate	47	Locking plate		
22	Pressure spring	31	Rubber cuff				

Trouble Shooting Hints for the Brake System

Job No.
42-30

Modification: various details added

A. Service Brake

Fault	Source of trouble	Remedy
Brake pedal meets with no resistance, and is soft and spongy	a) Air in the brake system b) Not enough brake fluid in the fluid reservoir	a) Bleed brake system b) Top up brake fluid and bleed the system
Brake system is bled, but brake pedal goes right down to the toeboard without producing any braking action	a) Leaky line b) Damaged or unserviceable cup in master, wheel, or pressure cylinder c) Check valve damaged on cars with drum brakes	a) Seal or replace brake line b) Replace unserviceable cup or piston seal c) Replace check valve
Brake pedal is soft and spongy after long down gradient travel	Brake fluid too hot	Give brake system time to cool and, if necessary, bleed
Brakes heat up when car is traveling or fail to release	a) Compensating port in brake master cylinder clogged b) Clearance between push rod and piston of brake master cylinder too small (on cars with one-circuit brakes) c) Piston of one of the brake wheel or pressure cylinders sticking d) Rubber parts swollen by use of unsuitable liquids e) Brake cable sticking	a) Clean compensating port b) Readjust brake pedal free play (see Job No. 42-20, Section B) c) Repair pressure or brake wheel cylinder d) Drain the brake system, dismantle and clean the whole brake system as specified. Replace all rubber parts including the brake hoses and the stop light switch. Fill brake system with ATE original brake fluid e) Replace brake cable
	Cars with drum brakes	
	f) Brake shoe return springs too weak or overtensioned g) Brake shoes sticking on anchor pin h) Clearance too small (on models with drum brakes and automatic adjustment)	f) Replace return springs g) Free up brake shoes on anchor pin h) Bolt of automatic adjustment is bent. Replace bolt. Measure clearance of the brake shoes.

Fault	Source of trouble	Remedy
	i) No play of push rod in case of light metal brake shoe rear wheel brake	i) Adjust the play of the push rod
	Cars with disk brakes	
	j) Special check valve keeps up residual pressure	j) Replace special check valve
	k) Lining carriers of the parking brake have scored the swing bolt	k) Free up the lining carrier
	Cars with power brake T 50	
	l) Vacuum piston of power brake fails to return to its end position or sticks	l) Check cup, spring, piston rod, and vacuum cylinder and replace damaged parts
	m) Ball valve in slave cylinder piston is not lifted from its seat	m) Check slave cylinder piston for fluid passage in both directions in released position and, if necessary, replace piston
	Cars with power brake T 51	
	n) Excessive force-fit between the push rod of the power brake and the piston of the tandem master cylinder	n) Replace power brake
Unsatisfactory braking action despite hard foot pressure	a) Brake shoes or friction pads oily or greasy	a) Seal rear axle shaft or front wheel hub. Replace brake shoes or friction pads
	b) Brake linings or friction pads charred	b) Replace brake shoes or friction pads
	c) Friction pads worn	c) Replace friction pads
	Cars with power brake T 50	
	d) Collapsed, restricted, or loose vacuum hose	d) Check vacuum hose and, if necessary, replace. Tighten hollow screw
	e) Leaking control valve	e) Replace power brake
	f) Low vacuum, though vacuum system is in order	f) Check engine and if necessary recondition valves
	g) Leaky ball valve in slave cylinder of power brake	g) Replace power brake
	h) Vacuum piston sticking	h) Replace power brake
	Cars with power brake T 51	
	i) Vacuum seals in tandem master cylinder damaged	i) Replace vacuum seals and lubricate piston shank with silicone
Brakes dragging on one side	Cars with disk brakes	
	a) Friction pads oily or greasy	a) Seal front wheel hub or rear axle shaft
	b) Friction pads in one brake caliper excessively worn	b) Replace friction pads
	c) Brake caliper not parallel to brake disk	c) Check seat of brake caliper and adjust
	d) Difference in friction value of pads (charred lining surface)	d) Replace friction pads
	e) Clearance in one brake caliper insufficient	e) On Dunlop brake caliper check clearance. If necessary, replace pressure cylinder. On Girling and Teves brake calipers check piston in brake caliper for ease of movement

Fault	Source of trouble	Remedy
Brakes dragging on one side	Cars with drum brakes	
	f) Wear pattern of brake linings bad and unequal	f) Recondition brake shoes
	g) Brake shoes too large in diameter on one brake	g) Recondition brake shoes
	h) Brake drums out-of-round or scored	h) Recondition brake drums or, if necessary, replace them. Interchange of brake drums of individual wheels may help, too.
	i) Excessive difference in diameter of brake drums	i) Equalize internal diameter of brake drums. If necessary, replace
	j) Brake linings oily or greasy	j) Seal rear axle shaft or front wheel hub. Replace brake shoes
	k) One brake shoe sticking on anchor pin	k) Free up brake shoe on anchor pin and correct axial play
	l) Wheel cylinder pistons sticking	l) Check wheel cylinders and, if necessary, repair
	m) Moisture in one brake	m) Brake hard several times
	n) Automatic adjustment not functioning properly	n) Check automatic adjustment and repair
Squeaking brakes	Cars with disk brakes	
	a) Friction pad loose on guide bolt of piston (only in case of Dunlop disk brake)	a) Use 12 mm ∅ pressure piece and lightly push in fitting plate on friction plate
	b) Friction pad has insufficient lateral play in the brake caliper gap	b) Replace friction pad (lightly grease guide surfaces in caliper gap with graphite grease or Molykote Paste "U".
	Cars with drum brakes	
	c) Faulty contact of front brake shoes with contact plate of brake anchor plate	c) Straighten contact plates
	d) Excessive clearance between brake shoe eye and anchor pin	d) Adjust clearance **Note:** The front wheel brakes are more liable to squeak than the rear wheel brakes. Particular care should therefore be given to this operation on the front wheel brakes.
	e) Bad wear pattern of the linings or charred lining surface	e) Recondition brake linings. If necessary exchange brake shoes
	f) Much abrasive dust in the brake	f) Thoroughly clean brake with compressed air

Fault	Source of trouble	Remedy
Rattling of brakes	a) Rear shock-absorbers unequal in effect	a) Replace rear shock-absorbers
	b) Rear axle suspension defective	b) Check rear axle suspension and, if necessary, repair
	c) Excessive disk wheel wobble	c) Check disk wheels and, if necessary, replace
	Cars with disk brakes	
	d) Run-out of brake disk	d) Check and correct run-out of brake disk
	e) Unsatisfactory wear pattern of friction pads	e) Run in friction pads
	f) Difference in overall thickness of brake disk	f) Install new brake disks with a thickness difference below 0.03 mm
	g) Coating on braking areas of brake disks	g) Clean brake disks with emery paper or abrasive pads (not grinding pads)
	Cars with drum brakes	
	h) Excessive out-of-roundness of rear brake drums	h) Check out-of-roundness of the brake drums by means of a dial gage. Out-of-roundness must not be in excess of 0.02 mm. If necessary, recondition the brake drums.
	i) Excessive variation in wall thickness of brake drums	i) Replace brake drums. The maximum permissible variation in wall thickness is 1 mm
	j) Bad wear pattern of brake linings	j) Recondition brake linings
Leaky pressure cylinder	a) Piston seal shrunk	a) Replace piston seal. (O. D. of piston seal must exceed piston ϕ by 1 mm).
	b) Scores in cylinder wall	b) Replace pressure cylinder
	c) Formation of rust on cylinder wall	c) Remove light rust patches. If necessary, replace brake caliper or pressure cylinder. Replace damaged dust caps.
Fluid reservoir needs frequent replenishing with brake fluid	a) Leak in hydraulic system	a) Check all lines, hoses, and unions for leaks. When doing this, press down brake pedal firmly and hold in position with pedal jack.
	b) Brake master cylinder leaking	b) Check brake master cylinder and, if necessary, replace secondary cup.
	c) Brake wheel cylinder or pressure cylinder leaking	c) Check wheel or pressure cylinder and, if necessary, replace cup or piston seal.
	d) Brake fluid escaping from leak port	d) Replace power brake

Fault	Source of Trouble	Remedy
	Cars with two-circuit brake system	
No or insufficient power assist	a) Insufficient vacuum	a) Measure the vacuum
	b) Vacuum line clogged	b) Check connection on check valve (plastic plug in front of valve)
	c) Damaged diaphragm in vacuum pump	c) Replace diaphragm
	d) Control housing in power brake damaged	d) Replace power brake
Power brake hissing in partly applied position	a) Leak in poppet assembly	a) Replace power brake
	b) Control housing broken	b) Replace power brake
Power brake run-out too early (brake pedal drops on slightest touch, brake action out of control)	Excessive travel of control piston	Replace power brake
Brake pedal can be depressed down to the cowl with moderate foot pressure	Damaged sleeve in suspended circuit of tandem master cylinder	Replace tandem master cylinder

B. Hand Brake

Fault	Source of Trouble	Remedy
	Cars with disk brake	
Hand brake ineffective	a) Excessive gap between friction pads and brake disk	a) Check automatic adjustment
	b) Worn friction pads	b) Replace friction pads
	c) Friction pads worn more on one side	c) Check position of leg spring, if necessary replace
	d) Excessive run-out of brake disk	d) Measure run-out and correct

C. Power Brake T 51

Fault	Source of Trouble	Remedy
Power brake snarls or knocks if applied quickly	Excessive distance between control piston and reaction disk	Replace power brake

Steering Assembly   Group 46

Job No.
46-0

Steering

General Data, Dimensions and Tolerances

Modification: Model 230 SL added
*Other modifications are marked **

A. Mechanical Steering

Oil Capacity of Steering

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL

Hypoid transmission oil SAE 90	0.3 liter
Oil Level Check	
Turn the steering worm in such a way the steering nut is in the lower part of the housing. To do this, turn the steering wheel completely to the **left** on left-hand drive models, and completely to the **right** on right-hand drive models. Then unscrew the screw plug from the steering housing cover and measure the oil * level with a depth gage. The oil level should be appr. 40 mm below the bore in the steering housing cover.	

Bearings of Steering Worm

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL

Play of angular contact bearings	
End play of steering worm (adjustable by adjusting ring)	0.00 mm to. 0.01 mm (practically no play)
Before tightening the hexagon nut, coat the contact surface of the nut and the thread of the adjusting ring with sealing compound.	

Pressure Block Assembly for Steering Shaft

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL

111 460 05 11	1st	42.5+1
	2nd	47.0+1
Adjustement of pressure block assembly (Only with the steering removed from the vehicle)		
* With the steering in center position back out the adjusting screw until it rests against the pressure sleeve. From this position turn in the screw to the point where a torque of 1.75 - 2.25 mkg is required to turn the steering shaft beyond the center position. Then lock the adjusting screw with the hexagon nut, making sure that the position is not changed. As an additional check turn the steering at the steering worm by means of the steering coupling and at the steering shaft by means of the steering gear arm. When the steering shaft passes the center position, it must on no account bind, but the point where there is a slight resistance must be noticeable (see also Job Nos 46-3 and 46-4). Before tightening the hexagon nut, coat the contact surface of the nut and the thread of the adjusting ring with sealing compound.		

Note: If the pressure spring does not pass freely over the 1st version pressure sleeve the pressure sleeve must be replaced or reconditioned satisfactorily.

B. DB Power Steering

Steering Power Assistance

Beginning of power assistance with a force acting on steering wheel circumference of kg	Beginning of manual power limitation	
	with a force acting on steering wheel circumference of kg	corresponds to an oil pressure of atm.
approx. 0.7	approx. 2.6	approx. 12.0

Oil Capacity of Power Steering

For type of oil see fuel and oil chart	approx. 1.5 litres
Oil level check	
With the engine running, the oil level should reach the level mark stamped in the reservoir (approx. 12 mm below the reservoir edge). Use absolutely clean oil for topping up since even the smallest impurities may cause trouble in the hydraulic system.	

Steering Gear Arm Position

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL, 300 SE

Distance "a" from outer face of the steering housing to center bore for ball stud in steering gear arm with center position check screw screwed in	76±3

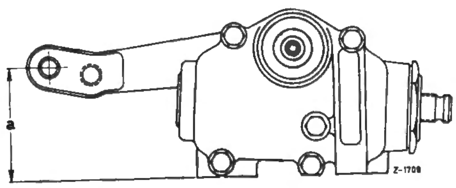


Fig. 46-0/3

Adjustment of Steering Relay Arm

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL, 300 SE

Distance 'a' between steering relay arm trunnion bearing (see Fig. 46-11/2) (Steering in center position or lever in straight-ahead position)	
Standard distance	Minimum distance
2.5 mm	1.0 mm

Tightening Torques

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL, 300 SE

Hexagon screws for fastening the steering to the chassis base panel	appr. 5 mkg
Hexagon castle nut for fastening the steering gear arm to the steering shaft	appr. 20 mkg
Hexagon nut for fastening the steering wheel to the steering tube	appr. 8 mkg
Hexagon socket screws for fastening the steering coupling to the steering tube or steering worm	appr. 2.5 mkg

Removal and Installation of Steering Assembly

Job No.
46-1

Removal:

1. Unscrew the hexagon socket screw (clamping screw) (8) from the lower flange (4) of the steering coupling (Fig. 46-1/1).

2. Detach the center tie-rod from the steering gear arm (see Job No. 46-9).

3. Unscrew the three hexagon screws (5) for fastening the steering assembly to the chassis base panel from the outside. Then pull the steering worm off the steering coupling and take out the steering assembly downward (Fig. 46-1/1).

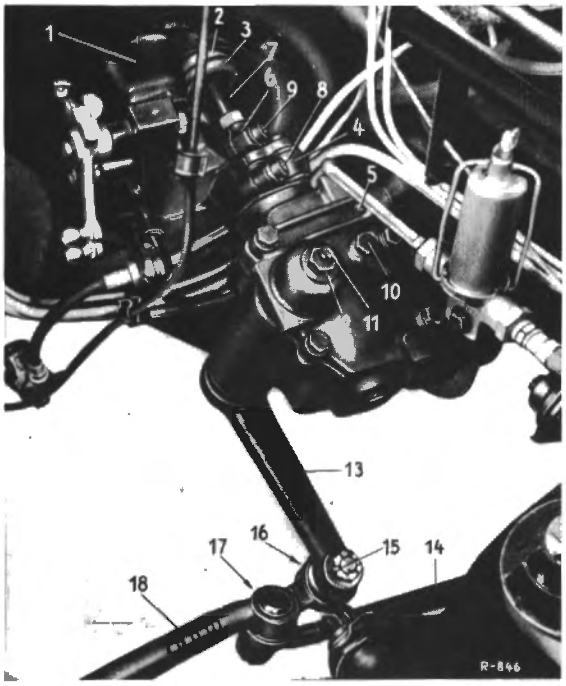


Fig. 46-1/1

1 Cover plate
2 Steering column jacket
3 Rubber cuff
4 Lower flange of steering coupling
5 Hexagon screws for fastening the steering assembly to the chassis base panel
6 Upper flange of steering coupling
7 Steering tube
8 Hexagon socket screw (lower clamping screw)
9 Hexagon socket screw (upper clamping screw)
10 Screw plug in steering housing cover
11 Adjusting screw for pressure block assembly of steering shaft
12 Hexagon nut (lock nut for adjusting screw)
13 Steering gear arm
14 Tie-rod
15 Castle nut with cotter pin
16 Ball joint for center tie-rod
17 Ball joint for tie-rod
18 Center tie-rod

4. Remove the steering gear arm (see Job No. 46-12).

Installation:

5. Check the steering coupling. If necessary, remove the coupling and reinstall after repair (see Job No. 46-13).

6. Attach the steering gear arm to the steering shaft, paying attention to the position markings (see Job No. 46-12).

7. Unscrew the screw plug (10) from the housing cover and fill up the steering assembly with the specified oil (for quantity and type of oil see Job No. 46-0).

8. Put the steering in center position and fix the position of the steering nut (4) by screwing Center Position Check Screw 111 589 00 23 (1) into the threaded bore for the screw plug in the steering housing cover (2) (Fig. 46-1/2).

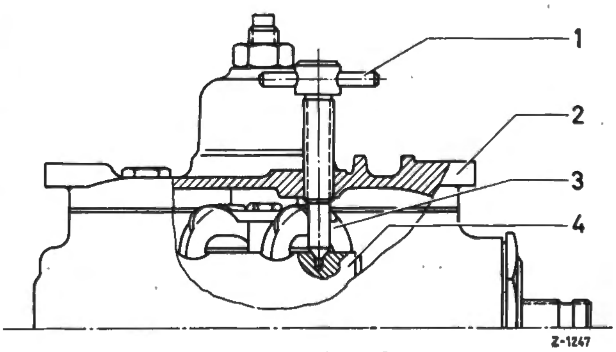


Fig. 46-1/2

1 Center Position Check Screw 111 589 00 23
2 Steering housing cover
3 Ball guide tube of the steering nut
4 Steering nut

Note:

a) Before screwing in the check screw, turn the steering worm until the center of the steering nut is exactly below the threaded bore in the housing cover, using a suitable

inspection lamp for the job. Then screw in the check screw.

b) Only Check Screw 111 589 00 23 should be used for checking the center position of the steering assembly. If a screw with a through-thread is used, the ball guide tube (3) of the steering nut situated beside the center may be damaged (Fig. 46-1/2).

9. Put the steering tube (19) in its center position. In this center position, the canceling cam (13) on the steering tube is opposite the center of the flash signal switch (18) (see Fig. 46-7/3). For inspection purposes remove the rubber cover (17) on the flash signal switch from the steering column jacket.

10. Press the steering worm into the steering coupling, making sure that the splines are not damaged and that the steering tube is in its correct position.

11. Fasten the steering assembly to the chassis base panel by means of the three hexagon screws. Insert the lower hexagon socket screw (clamping screw) into the steering coupling and tighten it (Fig. 46-1/1).

12. Turn out the center position check screw.

13. Attach the center tie-rod to the steering gear arm (see Job No. 46-9).

14. Turn the steering hard over to the left and to the right. In doing this check whether the steering knuckle arm rests against the steering knuckle assembly stop face (Fig. 46-1/3).

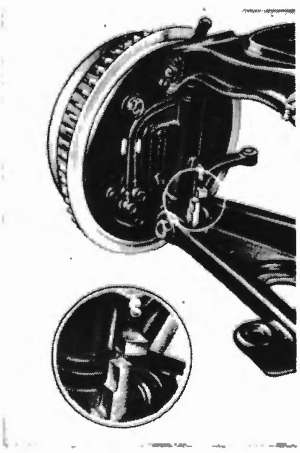


Fig. 46-1/3

Note: The steering must be limited by the steering knuckle assembly. If this is not the case, the cause may be an incorrectly installed steering gear arm or toe-in maladjusted on one side. For this reason, it is important to adjust the toe-in with the steering wheel in the center position, so that the toe-in on the left and on the right wheel is evenly distributed.

The steering nut must not strike against the safety stop faces (a) in the steering housing (Fig. 46-1/3a). The sole purpose of these stop faces is to exclude all possibility of fouling or pressure of the steering nut on the bearings of the steering worm.

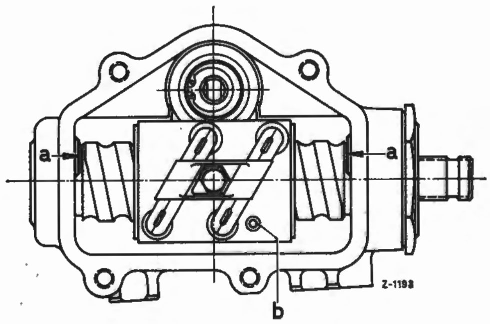


Fig. 45-1/3a

a Safety stop faces for the steering nut on the steering housing
b Center for the center position check screw in the steering nut

15. Check the toe-in (see Job No. 40-3).

16. Screw the screw plug (10) into the housing cover (see Fig. 46-1/1).

17. Check the position of the steering wheel during the trial run. When the wheels are in the straight fore and aft position, the steering wheel must also be in the dead center position. If necessary, the position of the steering wheel on the serrations can be corrected toward the right or left (see Job No. 46-2).

18. Check whether the automatic return mechanism of the flash signal switch is working properly.

Removal and Installation of Steering Wheel

Job No.
46-2

Removal:

1. Take off the trademark plate from the steering wheel (Fig. 46-2/1).

Fig. 46-2/1

2. Loosen the hexagon nut fastening the steering wheel to the steering tube and remove (Fig. 46-2/2). Then pull off the steering wheel by hand from the serrations of the steering tube.

Fig. 46-2/2

Note: Before taking off the steering wheel it is advisable to mark the relative positions of the steering wheel and the steering tube.

Installation:

3. Check the correct position of the retainer (11) for the contact ring (12) of the horns and of the pressure spring (30). Then put the steering wheel on the serrations of the steering tube (19), making sure that the wheel spokes are in their correct position (Fig. 46-2/3). Tighten the hexagon nut and lock washer.

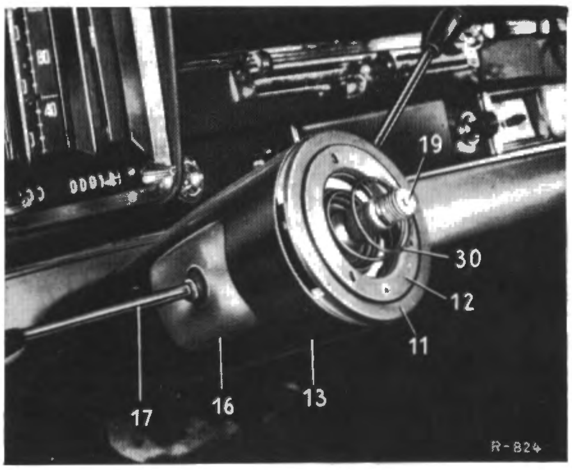


Fig. 46-2/3

11 Retainer for contact ring
12 Contact ring for horn actuation
13 Steering column jacket
16 Rubber cover for flash signal switch
17 Flash signal switch
19 Steering tube
30 Pressure spring

Note: If a new steering wheel is installed, whose position in relation to the steering tube could not be marked, the steering tube should be put in the center position.

When it is in its center position, the canceling cam (13) on the steering tube is opposite the center of the flash signal switch (18) (see Fig. 46-7/3). For inspection purposes remove the rubber cover (17) at the flash signal switch from the steering column jacket.

4. Check the position of the steering wheel on a trial run. When the wheels are in a straight fore and aft position, the steering wheel must also be in the dead center position. If, when the car is traveling straight ahead, the position of the steering wheel does not correspond to that of the front wheels, check the toe-in, and correct if necessary. If after that the position of the steering wheel still needs correction, change the position of the steering wheel on the serrations to the right or to the left.

5. Check the horns and check whether the automatic return mechanism of the flash signal switch is working properly.

Job No.
46-3

Checking the Play of the Steering Assembly Units

1. Check the play at the steering wheel. A maximum play of 25 mm is permissible at the circumference of the steering wheel.

Note: When checking the play it is advisable to have an assistant hold the front wheels steady.

2. If the play at the steering wheel exceeds this amount, check the play in the component parts of the whole steering assembly:

   a) **Front Wheel Bearings**
   If necessary, adjust or replace the annular taper roller bearings.

   b) **King Pin**
   Check by pushing the front wheels hard from side to side about the longitudinal axis. If necessary, replace the king pins or the bearing bushings (for dimensions see Job No. 33-0).

   c) **Steering Linkage**
   Check by moving the tie-rods vigorously. If necessary, replace the center tie-rod or the ball heads of the tie-rods (see Job No. 46-9).

   d) **Steering Relay Arm**
   Check by moving it vigorously up and down. If necessary, replace the steering relay arm and the bushing in the trunnion bearing (see Job No. 46–0 and 46–11).

   e) **Steering**
   If the steering play is excessive, remove the steering.
   Readjust the pressure block assembly for the steering shaft (see Job No. 46-0).
   If the end play of the steering worm is excessive, readjust the bearings by means of the adjusting ring in the upper part of the steering housing (see Job No. 46-0).
   If the radial play of the steering shaft is excessive, replace the shaft and if necessary the bearing bushings (for dimensions see Job No. 46-0).

   The pressure block assembly and the steering worm bearings must not be readjusted with the steering installed in the vehicle.

Adjustment of Steering

Job No.
46-4

Only with the Steering Removed from the Vehicle

Modification: Paras 4-7 on page 46-4/2

A. Steering Worm Play

1. Attach the steering to the assembly plate (25) which has been clamped in a vise (Fig. 46-4/2).

2. Completely loosen the pressure block assembly for the steering shaft (see Section B).

3. Check the steering worm for the specified end play (practically no play) (see Table in Job No. 46-0). The steering worm must turn easily, but there must not be any excessive play. If the steering worm does not move easily when the end play is adjusted correctly, disassemble the steering and check the bearing parts of the steering worm (Fig. 46-4/1).

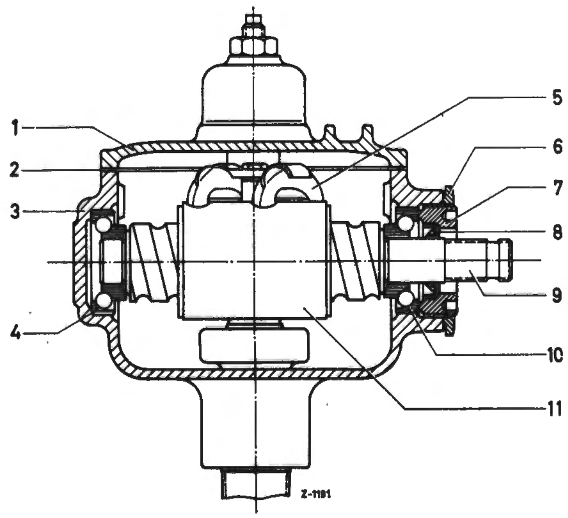


Fig. 46-4/1

1 Steering housing cover
2 Gasket
3 Steering housing
4 Angular contact bearing
5 Ball guide tube
6 Hexagon nut
7 Adjusting ring
8 Grease seal
9 Steering worm
10 Angular contact bearing
11 Steering nut

4. In order to adjust the end play of the steering worm, use Special Wrench 180 589 00 01 to loosen the hexagon nut (6). Then use Pin Wrench 000 589 00 05 to tighten the adjusting ring (7) until the specified end play of the steering worm is obtained (Figs. 46-4/1 and 46-4/2). Then tighten the hexagon nut, at the same time holding the adjusting ring steady in order to ensure that the adjustment is not changed. Again check the end play as described in para 3.

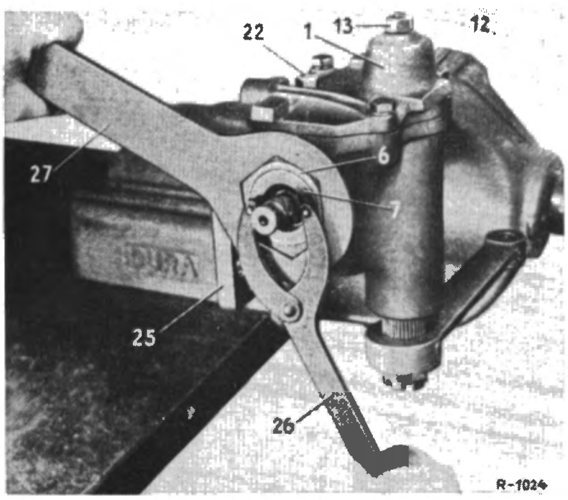


Fig. 46-4/2

1 Steering housing cover
2 Hexagon nut
7 Adjusting ring
12 Adjusting screw
13 Hexagon nut (lock nut)
22 Screw plug
25 Assembly plate
26 Pin Wrench 000 589 00 05
27 Special Wrench 180 589 00 01

Note: Before tightening the nut, coat the contact surface of the hexagon nut (6) and the thread of the adjusting ring (7) with sealing compound (Fig. 46-4/2).

5. Adjust the pressure block assembly for the steering shaft (see Section B).

B. Pressure Block Assembly for Steering Shaft

1. Check the play of the steering worm and, if necessary, readjust (see Section A).

2. Unscrew the screw plug (22) from the steering housing cover and check the adjustment of the pressure block assembly. As an additional check turn the steering at the steering worm by means of the steering coupling and at the steering shaft by means of the steering gear arm. When the steering shaft passes the center position, it must on no account bind, but the point where there is a slight resistance must be noticeable (Fig. 46-4/3).

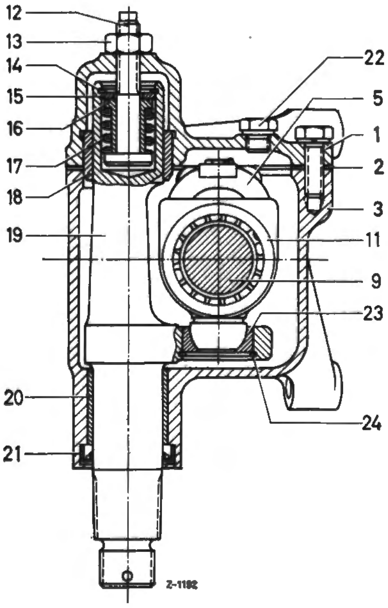


Fig. 46-4/3

1 Steering housing cover
2 Gasket
3 Steering housing
5 Ball guide tube
9 Steering worm
11 Steering nut
12 Adjusting screw
13 Hexagon nut
14 Snap ring
15 Thrust washer
16 Pressure sleeve
17 Compression spring
18 Upper bearing bushing
19 Steering shaft
20 Lower bearing bushing
21 Grease seal
22 Screw plug
23 Ball cup
24 Snap ring

3. In order to adjust the pressure block assembly of the steering shaft, put the steering in center position. In this position the center of the steering nut must be exactly below the threaded bore for the screw plug in the steering housing cover.

4. Put the steering gear arm on the steering shaft paying attention to the marks and the code number on the steering gear arm. Screw on the castle nut and tighten with a torque of approx. 20 mkg.

5. Use Torque Wrench 000 589 27 21 to measure the torque necessary to turn the steering shaft beyond the center position.

Note:

a) The torque should be 1.75-2.25 mkg and this value measured from lock to lock should not be exceeded.

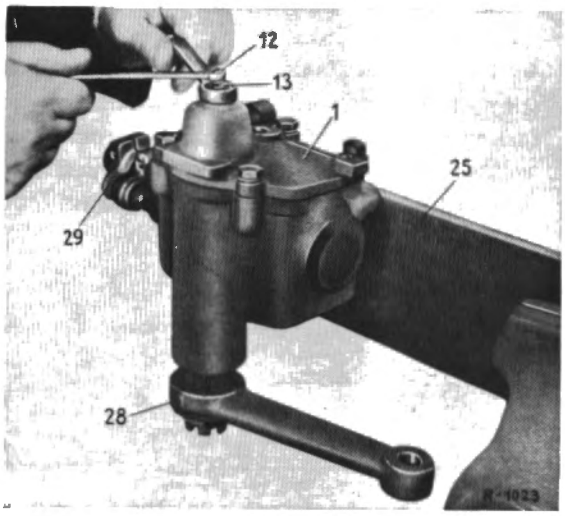


Fig. 46-4/4

1 Steering housing cover
12 Adjusting screw
13 Hexagon nut (lock nut)
25 Assembly plate
23 Steering gear arm
29 Steering coupling

b) If the steering does not work properly, check the pressure sleeve (16) and the compression spring (17) of the pressure block assembly for the steering shaft (Fig. 46-4/3, for dimensions see Job No. 46-0).

c) Before tightening the hexagon nut (13), coat the contact surface of the nut and the thread of the adjusting screw (12) with sealing compound (Fig. 46-4/3).

6. Check the oil level in the steering (see Job No. 46-0). Screw the screw plug into the steering housing cover.

7. Cotter the hexagon castle nut.

Removal and Installation of Steering Lock

Job No.
46-8

Modification: Models 190c, 190Dc and 300SE added

Removal:

Note: The steering lock has been combined with the starter switch so that the same operations are necessary to remove and install the starter switch.

1. Disconnect the ground cable from the battery.

2. Remove the instrument cluster (see Job No. 54-11).

3. Switch the steering lock to Position 1 and take out the ignition key.

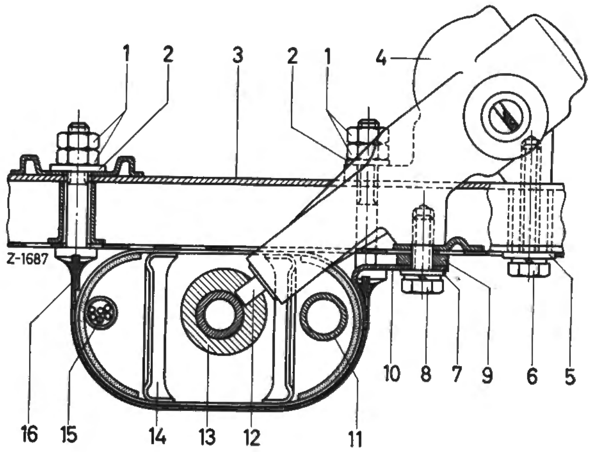


Fig. 46-8/2

Arrangement of steering column jacket and steering lock on Models 190 c, 190 Dc, 300 SE and 220 b, 220 Sb, 220 SEb Sedan, 2nd Version

1 Hexagon nuts
2 Washers
3 Cross member
4 Steering lock
5 Washer
6 Hexagon screw with lock washer
7 Washer
8 Hexagon screw with lock washer
9 Spacer washer
10 Bracket on steering column jacket for attachment of steering lock
11 Shift tube
12 Lock bolt of the steering lock
13 Lock ring on steering tube
14 Steering column jacket
15 Wiring harness for flash signal switch and signal horns
16 Tightening strap

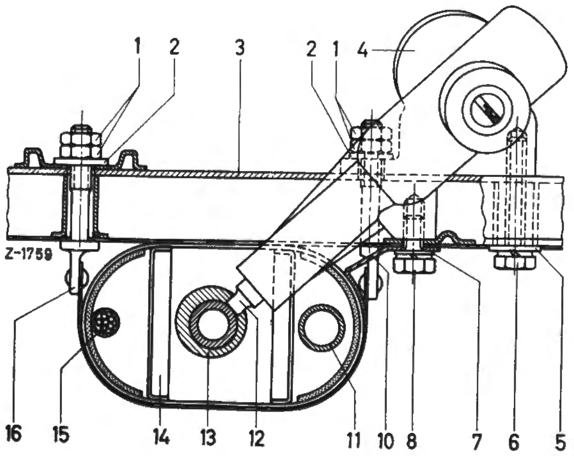


Fig. 46-8/1

Arrangement of steering column jacket and steering lock on Models 220 b, 220 Sb, 220 SEb Sedan, 1st Version

1 Hexagon nuts for tightening strap
2 Washer
3 Cross member
4 Steering lock
5 Washer
6 Hexagon screw and lock washer
7 Washer
8 Hexagon screw and lock washer
10 Bracket on steering column jacket for attachment of steering lock
11 Shift tube
12 Lock bolt of the steering lock
13 Lock ring on steering tube
14 Steering column jacket
15 Wiring harness for flash signal switch and signal horns
16 Tightening strap

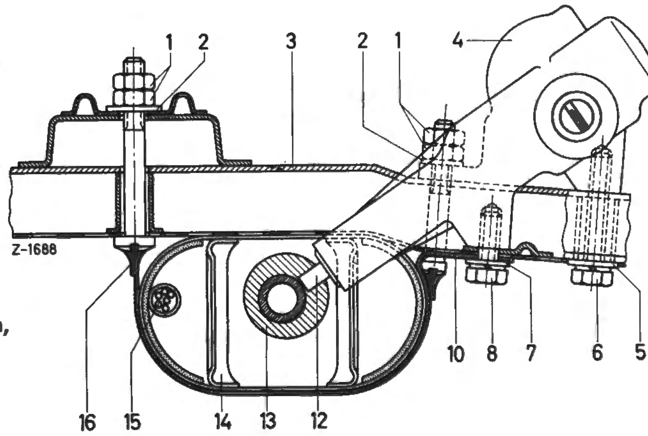


Fig. 46-8/3

Arrangement of steering column jacket and steering lock on Model 220 SEb/Coupé

1 Hexagon nuts
2 Washers
3 Cross member
4 Steering lock
5 Washer
6 Hexagon screw with lock washer
7 Washer with lock washer
8 Hexagon screw with lock washer
10 Bracket on steering column jacket for attachment of steering lock
12 Lock bolt of the steering lock
13 Lock ring on steering tube
14 Steering column jacket
15 Wiring harness for flash signal switch and signal horns
16 Tightening strap

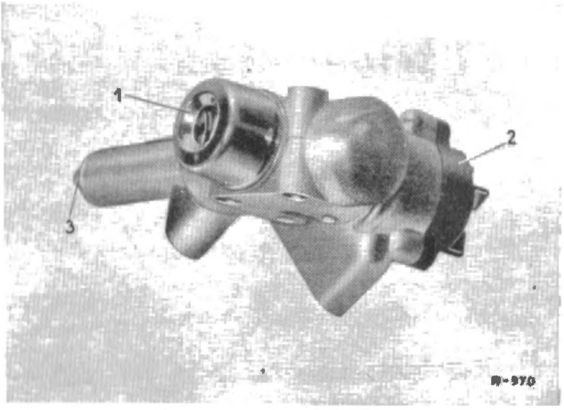


Fig. 46-8/4

1 Cylinder of the steering lock
2 Contact plate for the starter switch
3 Lock bolt

4. Unscrew the hexagon nuts (1) from the right threaded bolt of the tightening strap (16). Then unscrew the hexagon screws (6) and (8) for fastening the steering lock to the cross member (3) (Fig. 46-8/2).

5. Pull out the steering lock from the cut-out in the steering column jacket upward and at an angle and take it out downward.

6. Disconnect the cables at the contact plate of the steering lock and remove the steering lock (Fig. 46-8/4).

Installation:

7. Connect the cables to the contact plate of the steering lock paying attention to the color code. Connect the red cable to terminal 30,
   the red-black cable to terminal 15/54,
   the violet cable to terminal 50.
8. Switch the steering lock to Position 1 and take out the ignition key. Put in the lock and insert the hexagon screws (6) and (8) together with lock washer and washer. Screw on the two right hexagon nuts (1) and washers (2) for the tightening strap (16) and lock after tightening. (Figs. 46-8/2 and 3).

   Do not omit spacer washer (9) between bracket (10) and cross member (3) in the case of Models 190 c, 190 Dc and 300 SE and the 2nd version of Models 220 b, 220 Sb, 220 SEb Sedan (Fig. 46-8/2).

Note: The bracket (10) welded to the right side of the steering column jacket serves to accurately fix the position of the steering column jacket in relation to the steering lock.
The bracket was not installed on the first cars of these models.

9. Connect the ground cable to the battery.

10. Check whether the steering lock and the starter switch work properly in the various positions:

    Nose of the key half right:

    Position 0:
    Ignition switched off, key can be removed, steering column locked.

    Nose of the key half left:

    Position 1:
    Ignition switched off, steering column free, key can be removed.

    Nose of the key full left:

    Position 2:
    Ignition switched on, steering column free, key cannot be removed.

    On cars with gasoline engine, key pressed in from position 2 and turned right:
    Starter is being operated.

    When the engine has started, release the key which must then return to Position 2.

Note: When the instrument cluster has been removed, the oil pressure gage line must be plugged before starting the engine.

11. Install the instrument cluster (see Job No. 54-11).

Steering Lock on Model 230 SL

Removal:

1. Disconnect the ground cable from the battery.

2. Remove revolution counter, instrument cluster and speedometer (see Job No. 54-11, Section B).

3. Switch the steering lock to position 1 (garage) and pull of the key.

4. On cars with mechanical steering loosen the two hexagon socket screws (9) and (10) on the steering coupling (Fig. 46-8/5). Then remove the pipe clip (4) from the steering column jacket (7) (Fig. 46-8/6).

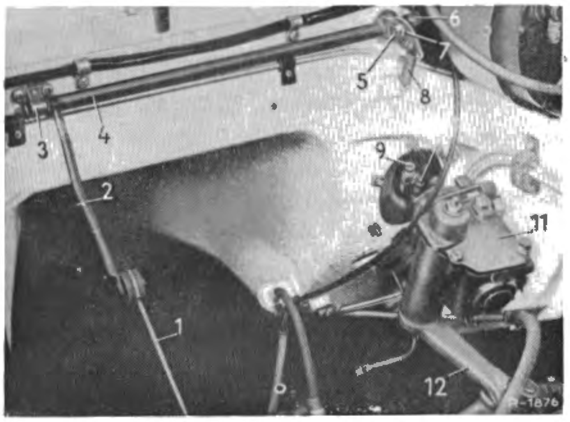


Fig. 46-8/5

1 Regulating rod
2 Lever
3 Bearing
4 Control shaft
5 Hexagon screw
6 Adjustment lever
7 Lever
8 Return spring
9 Hexagon socket screw
10 Hexagon socket screw
11 Steering
12 Steering gear arm

5. On cars with DB power steering remove the pipe clip (4) and the hexagon screws (6) for the cover plate (3). Then push the cover plate upward until the two hexagon socket screws on the steering coupling can be loosened (Fig. 46-8/6).

6. Unscrew the clamping screw on the steering column jacket (6) for the steering lock (9) (Fig. 46-8/7).

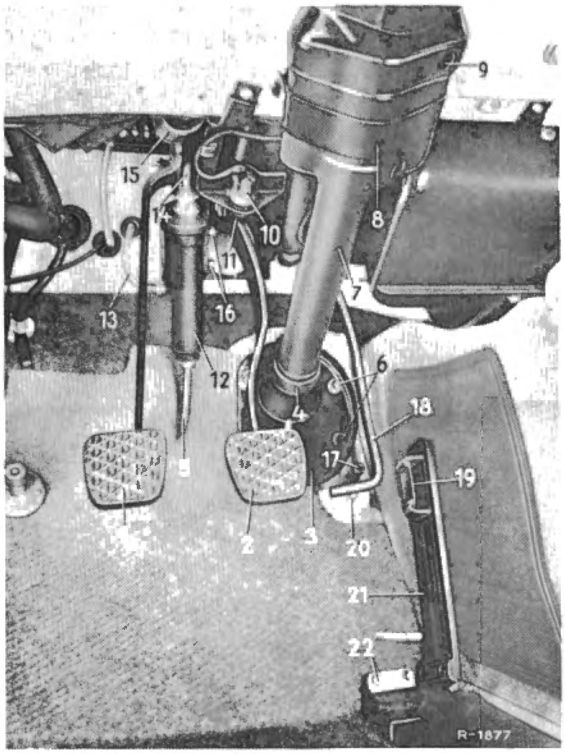


Fig. 46-8/6

1 Clutch pedal
2 Brake pedal
3 Cover plate
4 Pipe clip
5 Line to extraction cylinder
6 Hexagon screw with lock washer and washer
7 Steering column jacket
8 Tightening strap
9 Opening in steering column jacket for slotted screw on clamping ring
10 Mechanical stop light switch
11 Stop ring
12 Supply cylinder
13 Line from reservoir
14 Piston rod
15 Pressure spring (dead center spring)
16 Hexagon screw with lock
17 Stop screw
18 Adjustment lever
19 Plastic plate
20 Hexagon nut
21 Foot plate
22 Mounting plate

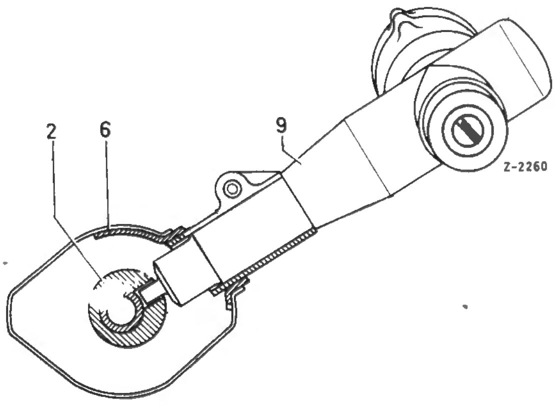


Fig. 46-8/7

2 Steering tube
6 Steering column jacket
9 Steering lock

7. Unscrew the hexagon nuts (12) from the threaded bolts of the tightening strap (10) and push the steering column jacket (6) forward until the steering lock no longer engages the opening in the instrument panel (Fig. 46-8/8).

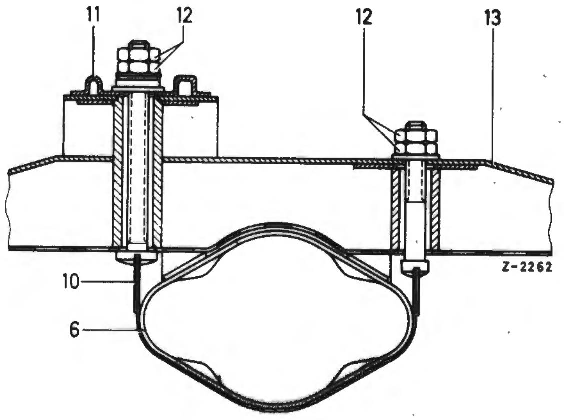


Fig. 46-8/8

6 Steering column jacket
10 Tightening strap
11 Support for the pedal system
12 Hexagon nut
13 Cross member

8. Turn the steering lock (8) 90° to the left and remove through the steering column jacket bracket, taking care to ensure that the escutcheon (7) is not damaged (Fig. 46-8/9).

Note: If it should be necessary the steering column jacket can be pushed slightly toward the left after removing the left cover.

9. Disconnect the cable from the contact plate and remove the steering lock.

Installation:

10. Connect the cables to the contact plate of the steering lock, paying attention to the color code as follows:
    Connect
    red cable to terminal 30
    red/black cable to terminal 15/54
    violet cable to terminal 50

11. Switch the steering lock to position 1 garage) and pull off the key.

12. Install the steering lock in the steering column jacket bracket and turn 90° to the right so that the steering lock accurately engages the recess in the instrument panel.

13. Pull the steering column jacket upward and on cars with mechanical steering attach the pipe clip and tighten the hexagon socket screws on the steering coupling. On cars with DB power steering first tighten the two hexagon socket screws on the steering coupling, then push the cover plate forward and attach it to the cowl by means of the hexagon screws. Then tighten the hexagon screw on the pipe clip.

14. Attach the tightening strap to the cross member.

15. Screw the clamping screw for the steering lock into the steering column jacket bracket.

16. Attach the ground cable to the battery.

17. Check to see whether the steering lock and the starter switch are working properly (see Section A, No. 10).

18. Install the speedometer, instrument cluster and revolution counter (see Job No. 54-11).

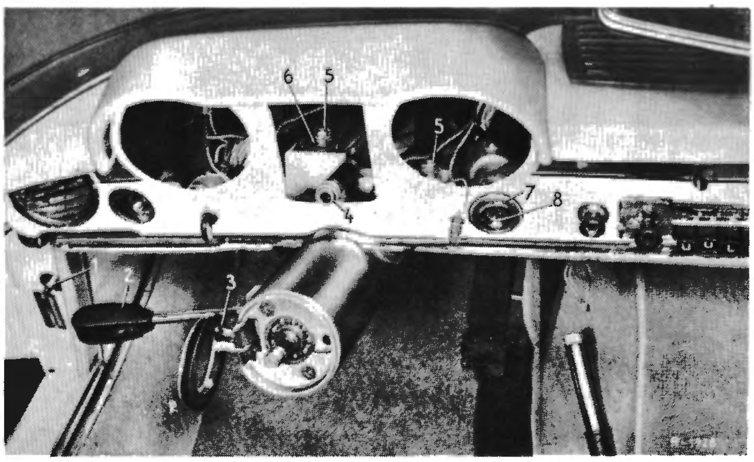


Fig. 46-8/9

1 Door contact switch
2 Combination switch
3 Contact ring
4 Flexible drive shaft
5 Hexagon nut
6 Washer
7 Escutcheon
8 Steering lock

Removal and Installation of Steering Linkage

Job No.
46-9

Modification: Fitting sleeve (Fig. 46-9/3a) and ball pin (Fig. 46-9/4c) added

A. Cars with 1st Version Front Axle

Removal:

Note: The operations with regard to the steering linkage described below refer to the two tie-rods and the center tie-rod.

1. Loosen and remove the hexagon screw fastening the steering shock-absorber (7) to the bracket (6) at the center tie-rod (5) (Fig. 46-9/1).

2. After removing the cotter pins, unscrew the castle nuts at the outside joints (4) of the tie-rods and at the joints (3) and (8) of the center tie-rod (Fig. 46-9/1).

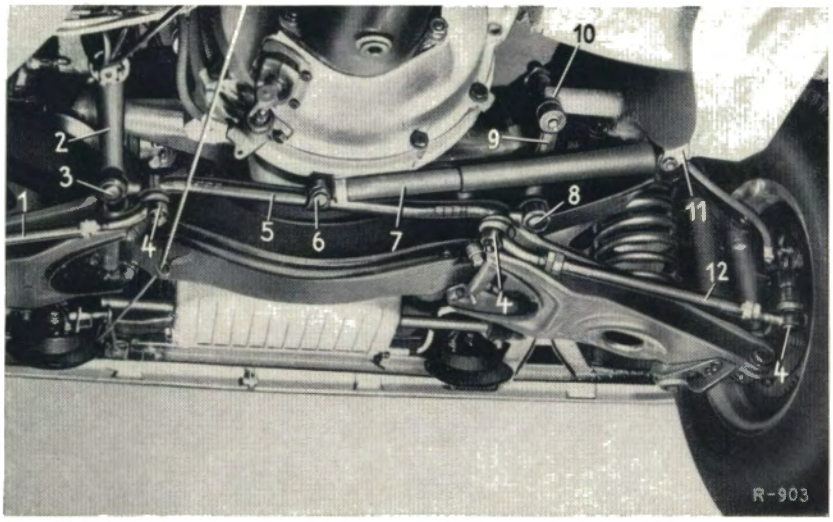


Fig. 46-9/1

1 Left tie-rod
2 Steering gear arm
3 Ball joint 25 mm ⌀ for center tie-rod
4 Ball joints 22 mm ⌀ for tie-rods
5 Center tie-rod
6 Bracket for steering shock-absorber on the center tie-rod
7 Steering shock-absorber
8 Pivot joint for center tie-rod
9 Steering relay arm
10 Trunnion bearing for steering relay arm
11 Bracket for steering shock-absorber on chassis base panel
12 Right tie-rod

3. Press out the tie-rods at the left and at the right from the steering knuckle arm and press out the center tie-rod from the steering gear arm and the steering relay arm, using Fixture 136 589 12 33 (Fig. 46-9/2 and 46-9/3). Remove the steering linkage.

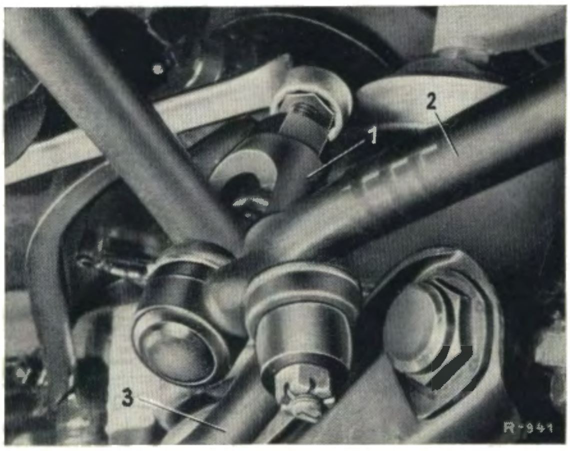


Fig. 46-9/2

1 Fixture 136 589 12 33 2 Center tie-rod 3 Tie-rod

Note: For all these joints which require no maintenance only a fixture with a base of 4.5 mm can be used. The modern version of Fixture 136 589 12 33 has a base of 4.5 mm Older versions of this fixture with a 7 mm base can be subsequently turned down or ground down provided that a minimum thickness of 4 mm is left.

Installation:

4. Check the joints of the tie-rods and of the center tie-rod. The two tie-rods have ball joints with a diameter of 22 mm, whereas the center tie-rod has a ball joint of 25 mm diameter at the left on the steering gear arm and a flexible pivot joint at the right on the steering relay arm (Fig. 46-9/4 a, b, c). The internal ball joint for the tie-rod is fitted in the center tie-rod (Fig. 46-9/1). If one of the joints is defective, the tie-rod end or the center tie-rod must be replaced. Fixture 136 589 12 33 should also be used to press the tie-rods off the ball pins in the center tie-rod.

5. **Check the rubber cuffs (2) for the joints. Damaged cuffs should always be replaced.** To do this, remove the clamping ring (3) and pull off the cuff. Before installing a new rubber cuff, fill the space between the cuff and the joint with the specified grease (see Job No. 46-0).

   On recent cars the rubber cuff (2) is attached to the tie-rod and center tie-rod by means of a flat wire clamping ring (3) and to the ball pin (1) by means of a plastic ring (10) (Fig. 46-9/4c). The two clamping rings should be installed with the aid of two fitting sleeves made according to the dimensions given in Fig. 46-9/3a. Without these fitting sleeves, assembly is extremely difficult, particularly assembly of the flat wire clamping ring (Fig. 46-9/3b).

Note: The two tie-rods and the center tie-rod are equipped with joints which require no maintenance, i. e. the grease reserve is sufficient for their service life and for that reason they have no grease fittings. **In the case of joints of this type, sealing against the entrance of dirt and sand is extremely important for the service life of the joints. This is the reason why damaged rubber cuffs should be replaced immediately since any dirt penetrating into the joint will make the joint unserviceable. For this reason it is very important that the the joints should carefully be checked at regular intervals.**

6. Check the hexagon nuts (9) and the locking plates (10) of the tie-rods and replace if necessary (Fig. 46-9/4c).

Note: The left-hand threads of the left and right tie-rod tubes are inside at the center tie-rod side.

7. Make sure that all traces of grease are removed from the ball pins and the conical seats in the steering knuckle arms, the steering gear arm and the steering relay arm. Install the steering linkage, and tighten and cotter the castle nuts.

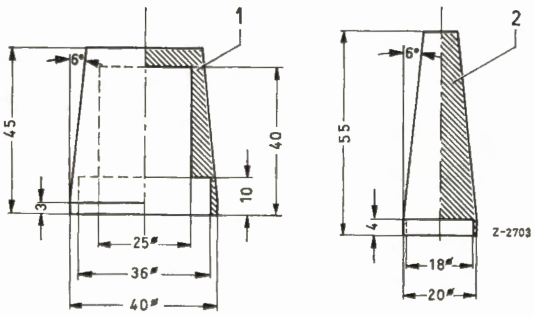


Fig. 46-9/3a

Fitting sleeve

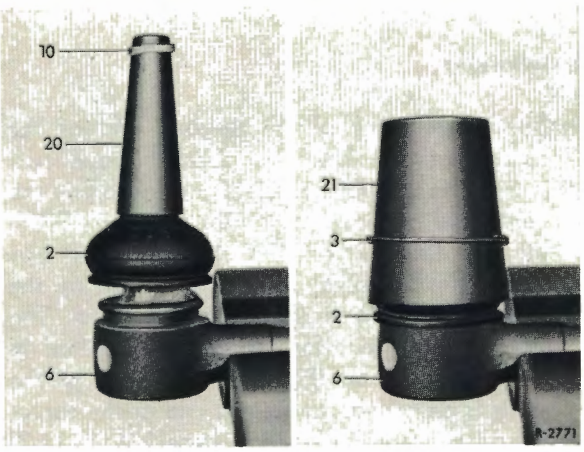


Fig. 46-9/3b

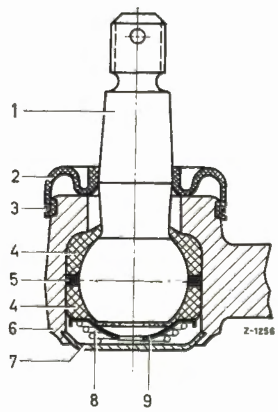


Fig. 46-9/4a

Ball joint on steering gear arm

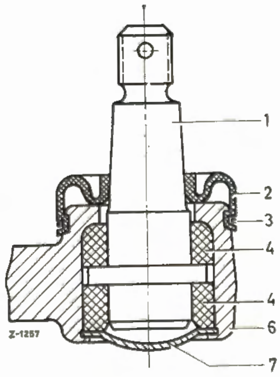


Fig. 46-9/4b

Pivot joint on steering relay arm

Center tie-rod

1 Ball pin
2 Rubber cuff
3 Clamping ring
4 Vulkollan bearing bushing
5 Spacer ring
6 Center tie-rod
7 Cover
8 Pressure spring
9 Retainer

1 Pivot
2 Rubber cuff
3 Clamping ring
4 Vulkollan bearing bushing
6 Center tie-rod
7 Cover

8. Install the steering shock-absorber on the center tie-rod (see Job No. 46-10).

9. Adjust the toe-in (for dimensions see Job No. 40-0).

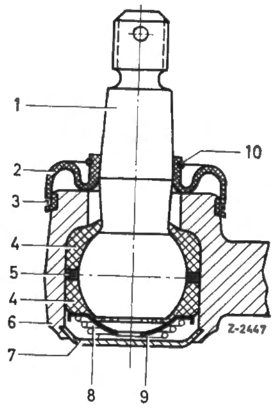


Fig. 46-9/4c

1 Ball pin
2 Rubber cuff
3 Flat wire clamping ring
4 Plastic bearing bushing
5 Spacer ring
6 Center tie-rod
7 Cover
8 Pressure spring
9 Retainer
10 Plastic clamping ring

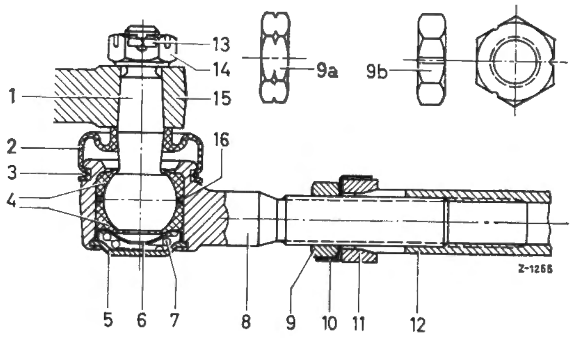


Fig. 46-9/4d

Tie-rod

1 Ball pin
2 Rubber cuff
3 Clamping ring
4 Vulkollan bearing bushing
5 Cover
6 Retainer
7 Compression spring
8 Tie-rod
9 Hexagon nut
10 Locking plate
11 Clamping ring
12 Tie-rod tube
13 Cotter pin
14 Castle nut
15 Steering knuckle arm
16 Spacer ring

B. Cars with 2nd Version Front Axle

a) Removal and Installation of Tie-Rod

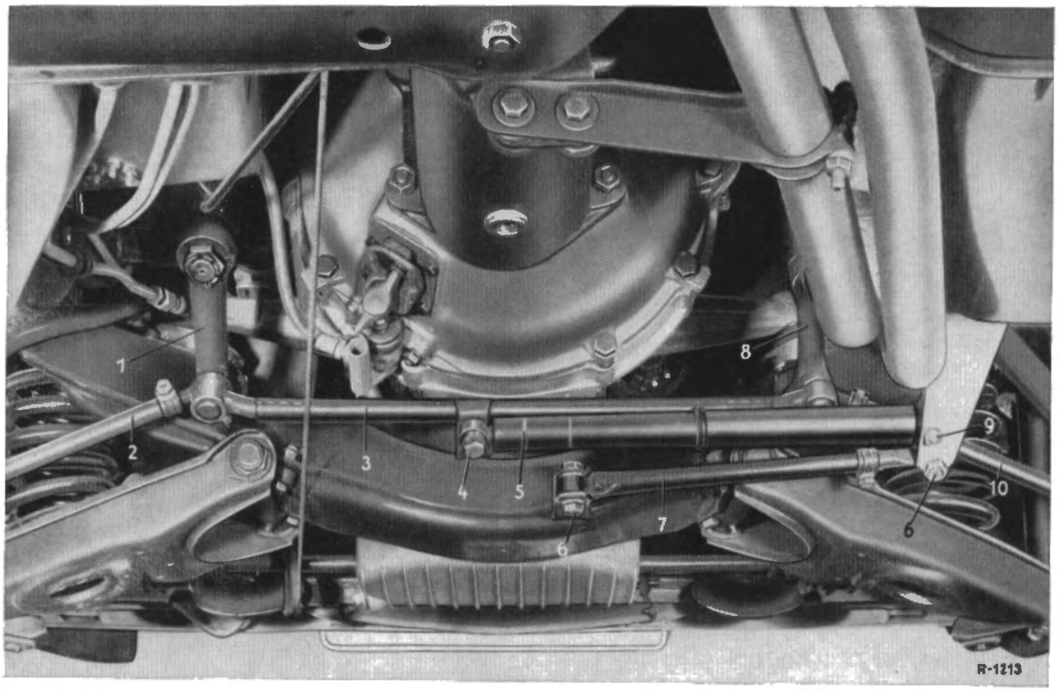


Fig. 46-9/5

1 Steering gear arm
2 Left tie-rod
3 Center tie-rod
4 Hexagon screw with lock washer
5 Steering shock-absorber
6 Hexagon screw with nut and lock washer
7 Strut for front axle lateral support
8 Steering relay arm
9 Hexagon screw with nut and lock washer
10 Right tie-rod

Removal:

1. After removing the cotter pins, unscrew the castle nuts from the joints (Fig. 46-9/5).

2. Press out the tie-rod from the steering knuckle arm, using Fixture 136 589 12 33 (Fig. 46-9/6).

3. Press out the tie-rod from the steering gear arm, using Fixture 186 589 10 33 (Fig. 46-9/7).

Note: a) If the center tie-rod has already been removed, Fixtures 136 589 12 33 or 111 589 08 33 can be used to press the tie-rod joints off the steering gear arm. When the center tie-rod

has not been removed, the puller rests against the center tie-rod joint.

b) To press the tie-rod joint off the steering relay arm (4) the strut (1) for the front axle lateral support must be removed (Fig. 46-9/8).

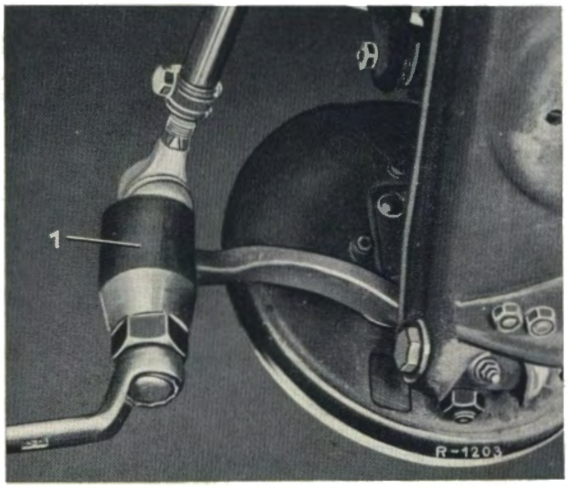


Fig. 46-9/6
1 Fixture 136 589 12 33

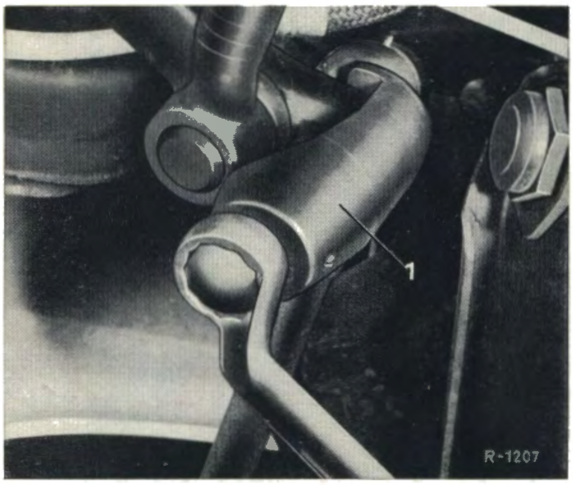


Fig. 46-9/7
1 Fixture 136 589 10 33

Installation:

4. Check the joints of the tie-rods. The tie-rods have ball joints with a diameter of 22 mm. If one of the joints is defective, the tie-rod end must be replaced.

5. **Check the rubber cuffs (10) for the joints. Damaged cuffs should always be replaced (see Section A, Item 5).**
   To do this, remove the clamping wire (9) and pull off the cuff (Fig. 46-9/9). Before installing a new rubber cuff, fill the space between the cuff and the joint with the prescribed type of grease (see Job No. 46-0).

Note: The two tie-rods and the center tie-rod are equipped with joints which require no mainte-

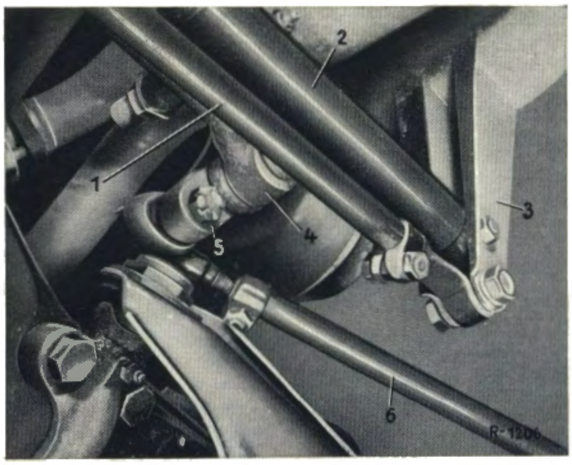


Fig. 46-9/8

1 Strut for front axle lateral support
2 Steering shock-absorber
3 Bracket on chassis base panel
4 Steering relay arm
5 Castle nut with cotter pin
6 Right tie-rod

nance, i. e. the grease reserve is sufficient for their service life and for that reason they have no grease fittings. **In the case of joints of this type, sealing against the penetration of dirt and sand is extremely important for the service life of the joints. This is the reason why damaged rubber cuffs should be replaced immediately since any dirt penetrating into the joint will make the joint unserviceable. For this reason it is very important that the joints should be checked carefully at regular intervals.**

6. Make sure that all traces of grease are removed from the ball pins and the conical seats in the steering knuckle arms, the steering gear arm and the steering relay arm. Install the tie-rod, tighten and cotter the castle nuts.

Note: The tie-rods must be fitted so that the tie-rod end with left-hand thread is positioned on the left side seen in the direction of travel.

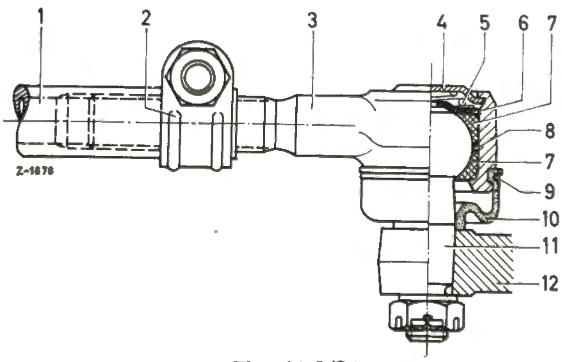


Fig. 46-9/9

1 Tie-rod tube
2 Clamp
3 Tie-rod end
4 Cover
5 Pressure spring
6 Retainer
7 Vulkollan bearing bushing
8 Spacer ring
9 Clamping wire
10 Rubber cuff
11 Ball pin
12 Steering knuckle arm

b) Removal and Installation of Center Tie-Rod

Removal:

1. After removing the cotter pins, unscrew the castle nuts from the joints.

2. Unscrew the hexagon screw fastening the steering shock-absorber and press the steering shock-absorber out of the bracket.

3. Press out the center tie-rod by means of Fixture 111 589 08 33 (Fig. 46-9/10).

Installation:

4. Check the joints in the center tie-rod.

5. Make sure that all traces of grease are removed from the ball pins and the conical seats in the steering gear arm and the steering relay arm. Install the center tie-rod, tighten and cotter the castle nuts.

6. Attach the steering shock-absorber to the center tie-rod.

Fig. 46-9/10

1 Fixture 111 589 08 33

Removal and Installation of Steering Shock-Absorber

Modification: Dust-protected version with pictures added

Removal:

1. Loosen and remove the hexagon screw holding the steering shock-absorber to the bracket (5) on the chassis base panel and also the hexagon screw the steering shock-absorber to fastening the center tie-rod (3) (Fig. 46-10/1).

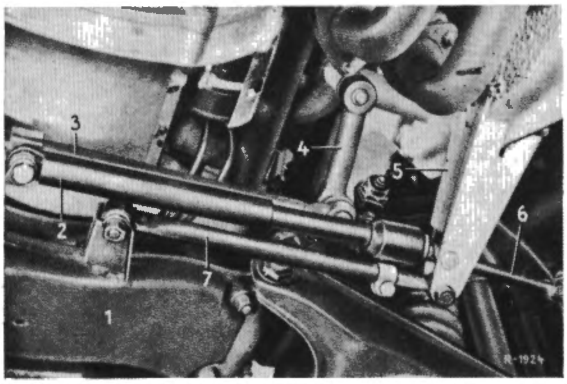


Fig. 46-10/1

1 Front axle support
2 Steering shock-absorber
3 Center tie-rod
4 Steering relay arm
5 Bracket on the chassis base panel
6 Right tie-rod
7 Strut for lateral support of front axle

2. Remove the steering shock-absorber.

Installation:

3. Check the steering shock-absorber (see Job No. 46-0) and the two rubber mountings.

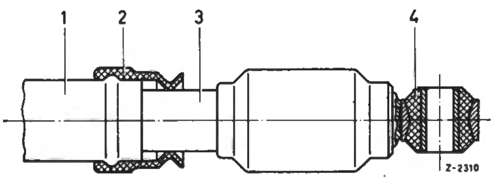


Fig. 46-10/2

Dust-protected version

1 Protective sleeve
2 Rubber sleeve
3 Shock-absorber tube
4 Rubber mounting

Note: In vehicles which are in use in areas where excessive dust conditions prevail, the shock-absorbers installed at our works are already provided with a rubber sleeve (2) for protection against dust and sand between the shock-absorber tube and the protective sleeve (Fig. 46-10/2). Replacement shock-absorbers will always be of the dust-protected type. In standard cars, this rubber sleeve is not installed (see Fig. 46-10/1).

4. Install the steering shock-absorber, making sure that the side with the inscription 'Rahmenseite' (chassis side) points toward the bracket on the chassis base panel (Fig. 46-10/3).

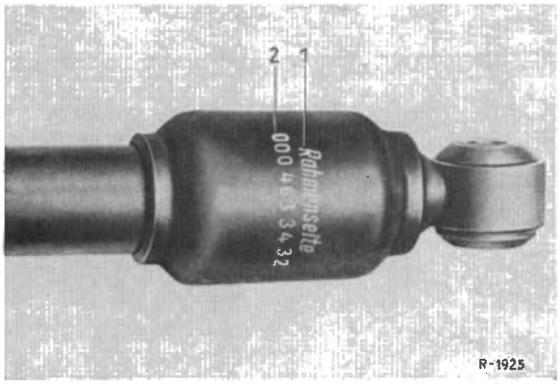


Fig. 46-10/3

1 Assembly marking
2 Part number

5. Insert the hexagon screws and tighten the nuts together with the lock washers.

6. In special cases, e. g. after an accident, check the safety clearance of the steering shock-absorber, which should be at least 5 mm. In order to check the shock-absorber, disconnect the shock-absorber on one side while the wheels are in a right and left lock and compress and extend it as far as it will go.

Note: If the safety clearance is found to be inadequate, check whether
the steering gear arm or the steering relay arm is bent,
the mounting for the steering shock-absorber is in order,
the piston rod of the steering shock-absorber is bent,
the toe-in is correctly adjusted and distributed evenly a both front wheels.

Removal and Installation of Steering Relay Arm

Job No.
46-11

Modification: 2nd and 3rd version added

Removal:

1. On cars with the first version front axle detach the center tie rod and on cars with the second version front axle detach the center and right tie rod from the steering relay arm.

2. Tap up the locking plate (2) for the cover plate (1) on the top of the trunnion bearing (3) of the steering relay arm (4). Then loosen the cover plate and remove together with the pressure spring and the thrust washer. Pull the arm out of the trunnion bearing downward (Fig. 46-11/1).

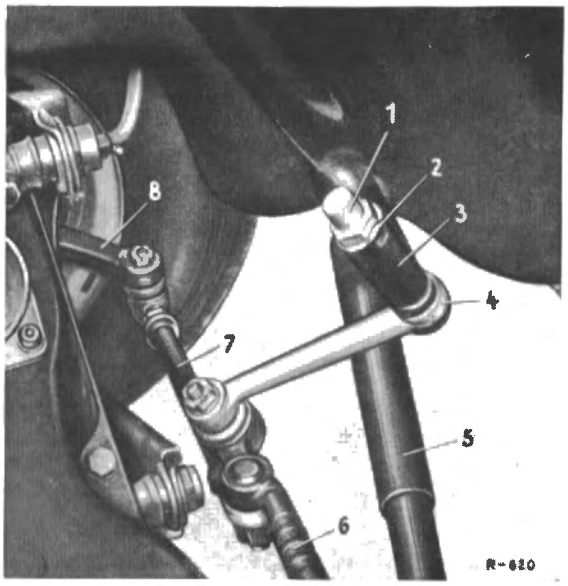


Fig. 46-11/1

1 Cover plate
2 Locking plate
3 Trunnion bearing on chassis base panel
4 Steering relay arm
5 Steering shock-absorber
6 Center tie-rod
7 Right tie-rod
8 Steering knuckle arm

Note: Before unscrewing the cover plate it is advisable to measure and mark the distance 'a' between the steering relay arm and the trunnion bearing in the straight-ahead position (see Fig. 46-11/2 and No. 7).

Checking and Repairing:

3. Check the steering relay arm (for dimensions and illustrations see Job No. 46-0).

4. Check the pin of the steering relay arm (8) and the bushing (6) in the trunnion bearing (5) for wear (for dimensions see Job No. 46-0). If the pin is worn, replace the arm. If necessary, tap out the bushing including the grease seal (7) from the trunnion bearing Fig.46-11/2).

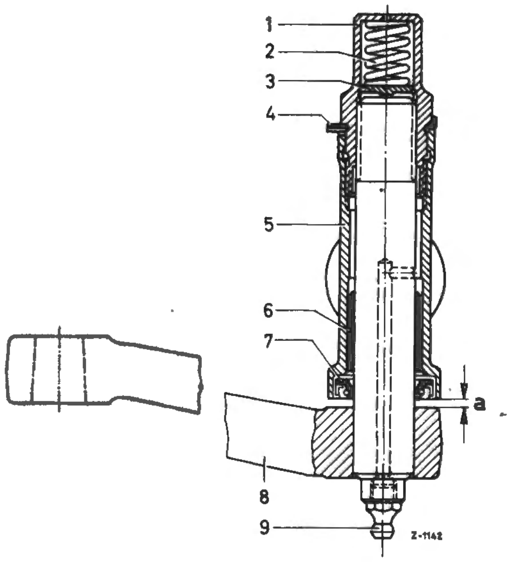


Fig. 46-11/2
1st version

1 Cover plate
2 Pressure spring
3 Thrust washer
4 Locking plate
5 Trunnion bearing
6 Bushing
7 Grease seal
8 Steering relay arm with pin
9 Grease fitting

Note: As a replacement part, the steering relay arm is only supplied together with the pin, since under ordinary workshop conditions the pin cannot be pressed into the relay arm.

5. Carefully press the new bushing into the trunnion bearing with the chamfered side upward (Fig. 46-11/2). Then ream out the bushing to the specified final dimension (for dimensions see Job No. 46-0).

Installation:

6. Press a new grease seal (7) into the trunnion bearing (5) with the sealing lip to the outside (Fig. 46-11/2).

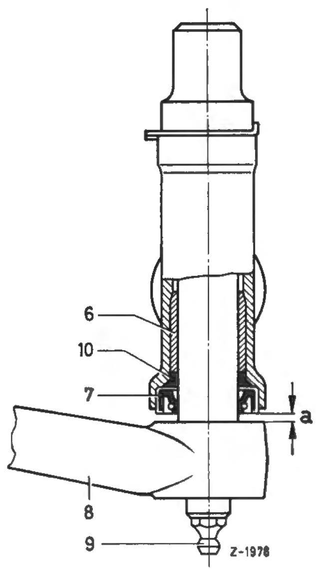


Fig. 46-11/3

2nd version

6 Bushing
7 Grease seal
8 Steering relay arm
9 Grease fitting
10 Vulkollan ring

Note:

a) It is important for the sealing lip of the grease seal to point to the outside so that the pressure developed during lubrication and also any superfluous grease can escape between the sealing lip and the steering relay arm.

If the grease seal is incorrectly installed, it might be pressed out by the pressure created.

b) On the 2nd version a Vulkollan ring (10) is located between the grease seal (7) and the bushing (6). The Vulkollan ring is intended to prevent rattling noises and can be installed subsequently together with a modified grease seal.

c) The 3rd version contains a combined grease seal (8) with a Vulkollan bushing (Fig. 46-11/4).

7. Coat the pin of the steering relay arm (8) and the bushing (6) with antifriction bearing grease. Then insert the steering relay arm. Put on the thrust washer (3) and the pressure spring (2) and screw on the cover plate (1) in such a way that in the straight-ahead position with the cover screwed right in the height of the steering relay arm corresponds to the height of the steering gear arm (pivot point distance) (see also Job No. 40-3).

Note:

a) The height of the steering relay arm can be adjusted because the internal thread of the cover plate has a pitch of 2 mm, whereas the external thread has a pitch of 1 mm.

Under normal circumstances the height of the steering gear arm and of the steering relay arm will coincide if in the straight-ahead position the standart distance 'a' (see Job No. 46-0) beween steering relay arm and trunnion bearing is maintained.

The prescribed minimum distance between steering relay arm and trunnion bearing in the straight-ahead position should never

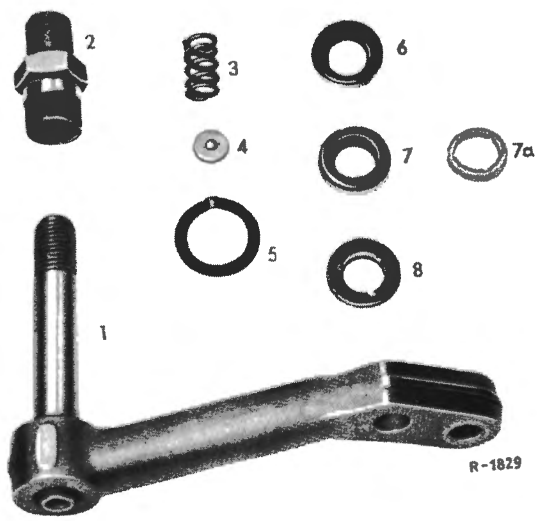


Fig. 46-11/4

1 Steering relay arm
2 Cover plate
3 Pressure spring
4 Thrust washer
5 Locking plate
6 Grease seal
7 Grease seal
7a Vulkollan ring
8 Combined grease seal with Vulkollan bushing

be less than the prescribed distance, since otherwise the relay arm may foul the trunnion bearing.

b) When installing a new steering relay arm make sure that the proper arm suitable for the particular car is installed. In order to avoid confusion between the various types of steering relay arms they are now being provided with code numbers (see Job No. 46-0).

8. When the adjustment of the steering relay arm is correct, tighten the cover plate (1) and lock (Fig. 46-11/2).
9. Attach the center tie-rod or when required center tie-rod and tie-rod to the steering relay arm (see Job No. 46-9).
10. Press grease into the grease fitting (9) on the pin of the steering relay arm (Fig. 46-11/2).
11. Check the toe-in (see Job No. 40-3).

Removal and Installation of Steering Gear Arm

Job No.
46-12

Modification: Cars with 2nd Version Front Axle (Addition)

A. Cars with 1st Version Front Axle

Removal:

1. Detach the center tie-rod (18) from the steering gear arm (13) (Fig. 46-12/1 and Job No. 46-9).

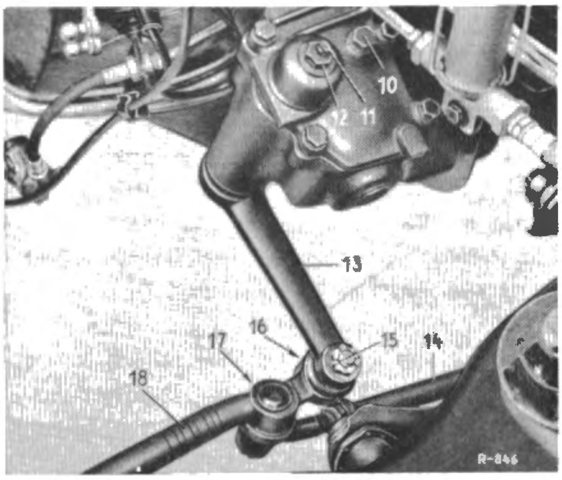


Fig. 46-12/1

10 Screw plug
11 Adjusting screw
12 Hexagon nut
13 Steering gear arm
14 Tie-rod
15 Castle nut with cotter pin
16 Ball joint of the center tie-rod
17 Ball joint of the tie-rod
18 Center tie-rod

2. After removing the cotter pin, unscrew the castle nut fastening the steering gear arm (13) to the steering shaft. Then pull off the steering gear arm by means of Fixture 186 589 04 33 (Fig. 46-12/1).

Installation:

3. Check the steering gear arm (for dimensions see Job No. 46-0 and Fig. 46-0/1).

4. Clean the serrations on the steering gear arm and on the steering shaft. Screw in the center position check screws, place the steering gear arm on the steering shaft, making sure that the markings on the gear arm correspond to the markings on the shaft. Check the correct positioning of the steering gear arm (see Job No. 40-3, Section D).

5. Screw out the center position check screw, screw on the castle nut and tighten well. After a firm blow on the steering gear arm finally tighten the nut and cotter.

6. Install the center tie-rod (see Job No. 46-9).

7. Check the toe-in (for dimensions see Job No. 40-0).

B. Cars With 2nd Version Front Axle

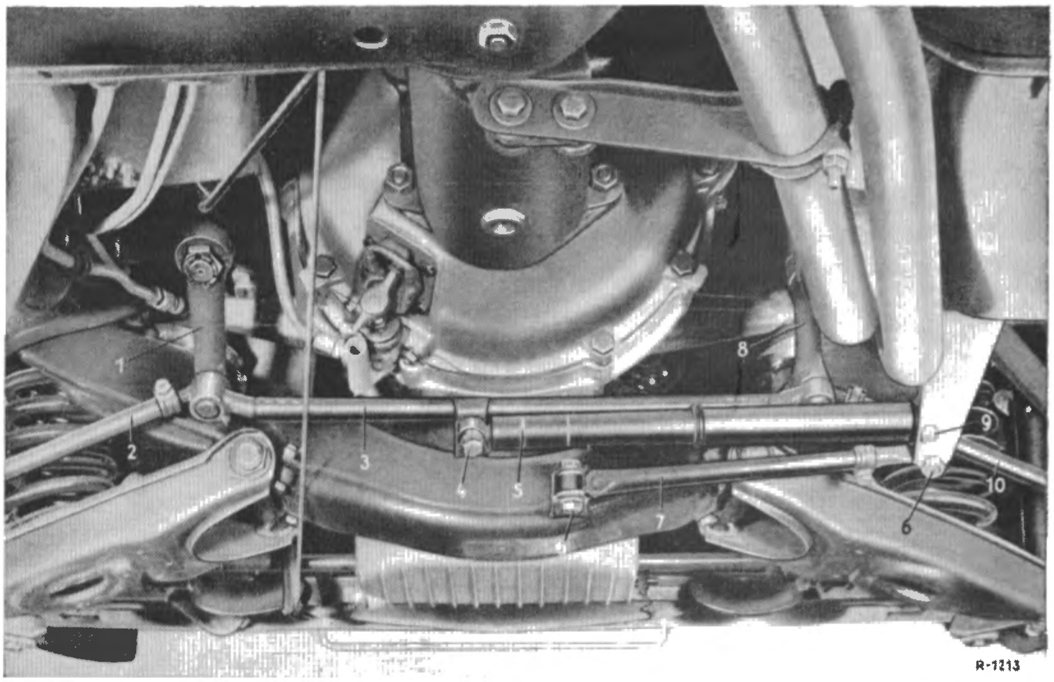


Fig. 46-12/2

1 Steering gear arm
2 Left tie-rod
3 Center tie-rod
4 Hexagon screw with lock washer
5 Steering shock-absorber
6 Hexagon screw with nut and lock washer
7 Strut for front axle lateral support
8 Steering relay arm
9 Hexagon screw with nut and lock washer
10 Right tie-rod

Removal:

1. Disconnect the tie-rod (2) and the center tie-rod (3) from the steering gear arm (1) (Fig. 46-12/2).

2. After removing the cotter pin, unscrew the castle nut fastening the steering gear arm (1) to the steering shaft. Then pull off the steering gear arm by means of Fixture 186 589 04 33 (Fig. 46-12/2).

Installation:

3. Check the steering gear arm (for dimensions see Job No. 46-0).

4. Clean the serrations on the steering gear arm and on the steering shaft. Screw in the center position check screw, place the gear arm on the steering shaft, making sure that the markings on the gear arm correspond to the markings on the shaft. Check the correct position of the steering gear arm (see Job No. 40-3, Section D).

5. Unscrew the center position check screw, screw on the castle nut and tighten well. After a firm blow on the steering gear arm finally tighten the nut and cotter.

6. Install the tie-rod and center tie-rod (see Job Nos. 46-9).

7. Check the toe-in.

Removal and Installation of Steering Coupling

Job No. 46-13

Modification: Installation Instruction para 7

Removal:

1. Unscrew the hexagon socket screw (lower clamping screw) (8) from the lower flange (4) of the steering coupling (Fig. 46-13/1).

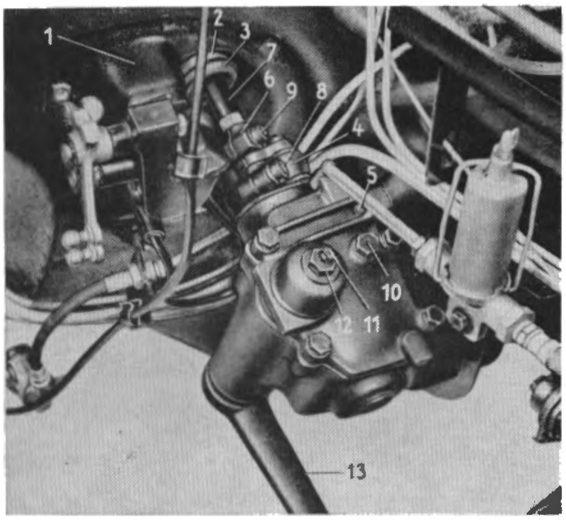


Fig. 46-13/1

1 Cover plate
2 Steering column jacket
3 Rubber cuff
4 Lower flange of steering coupling
5 Hexagon screws for attaching the steering to the chassis base panel
6 Upper flange of steering coupling
7 Steering tube
8 Hexagon socket screw (lower clamping screw)
9 Hexogan socket screw (upper clamping screw)
10 Screw plug in steering housing cover
11 Adjusting screw for pressure block assembly of steering shaft
12 Hexagon nut (lock nut for adjusting screw)
13 Steering gear arm

2. Unscrew from the outside the three hexagon screws (5) fastening the steering assembly to the chassis base panel. Press the steering worm off the steering coupling and slightly lower the steering assembly (Fig. 46-13/1).

3. Unscrew the hexagon socket screw (upper clamping screw) (9) from the upper flange (6) of the steering coupling and press the steering coupling off the steering tube 46-13/1).

4. Remove the cotter pins from the two bolts (2) and take off the washers (3) (Fig. 46-13/2). Then pull off the lower flange (4) from the upper flange (6) and remove the two bushings (5).

Installation:

5. Check the bushing (5) and the washers (3) and, if necessary, replace them. Also check the bolts in the upper flange and the two bores for the bushings in the lower flange (For dimensions see Table in Job No. 46-0).

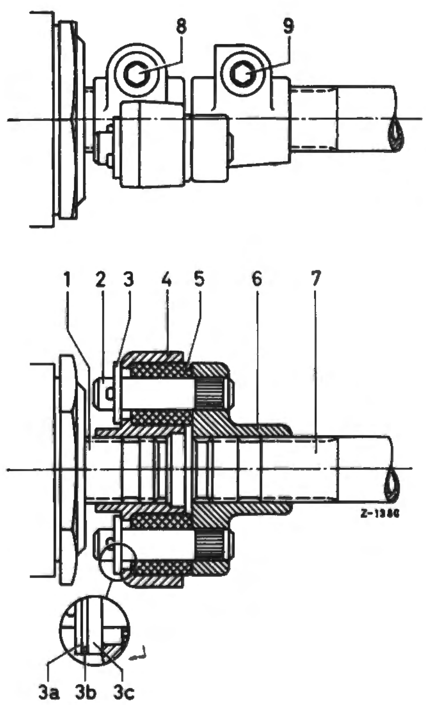


Fig. 46-13/2

1 Steering worm
2 Bolt
3 Washers
3a Steel washer
3b Spring washer
3c Plastic washer
4 Lower flange
5 Bushing
6 Upper flange
7 Steering tube
8 Hexagon socket screw (lower clamping screw)
9 Hexagon socket screw (upper clamping screw)

6. Press the bushings into the lower flange (4) and press the flange onto the bolts (2) in the upper flange. Then slightly compress the two flanges in a vise, push on the washers (3), the inside plastic washers, the spring washers in the middle and the outside steel washers, and cotter (Fig. 46-13/2).

Note:

a) On the first cars of this series the plastic bushings were installed with less force-fit, so that in certain cases the steering coupling may produce a cracking noise because of the play still present (see Job No. 46-0). On such steering couplings an attempt should be made to obtain a sufficient force-fit of the bushings by using plastic bushings with an outside diameter close to the upper tolerance limit. If necessary, the lower flange should be replaced.

b) On the first cars of this series the steel washers (3a) were not installed. When repairs are carried out, these washers, Part No. 136 990 95 40, should be subsequently installed (steel washers with an inside diameter of 10 mm, an outside diameter of 17 mm, and a thickness of 1 mm).

7. Press the steering coupling onto the serrations of the steering tube, screw in the hexagon socket screw (upper clamping screw) (9) together with the lock washer and tighten with the specified tightening torque (see Fig. 46-13/2 and Job No. 46-0).

Caution: The clamping screws (8) and (9) must be carefully tightened in order to prevent the steering tube from sliding out of the steering coupling.

8. Install the steering assembly according to Job No. 46-1 from para 8 onward.

Servicing of Power Steering

Job No.
46-21

Periodical Maintenance Work

Modification: Para 1

1. **After an initial mileage of 500 and 3000 km (Vouchers C, D, E) and subsequently whenever the car is being serviced** check the tension of the V-belt driving the high-pressure oil pump. Thumb pressure deflection of the V-belt should be 10-15 mm.

Models 220 b, 220 Sb, and 220 SEb

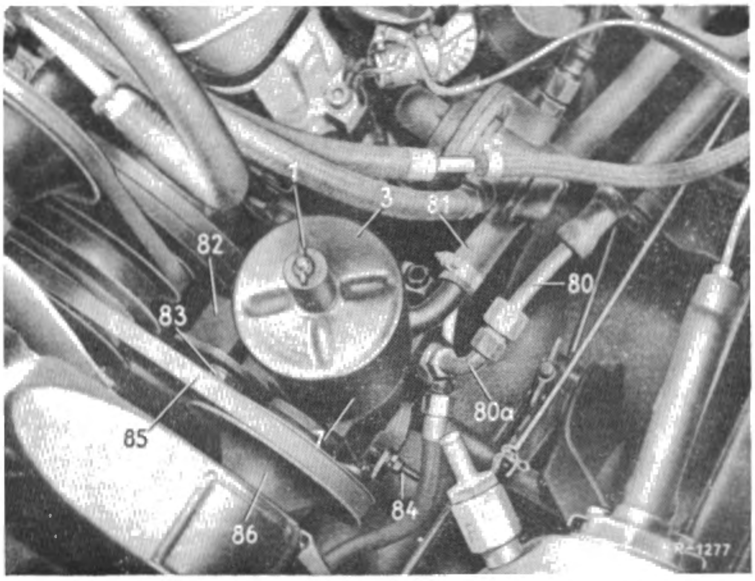


Fig. 46-21/1

Arrangement of high-pressure oil pump on Models 220 b, 220 Sb

1 Wing nut
3 Cover
7 Reservoir
80 High-pressure oil hose
80a Elbow on high-pressure oil pump
81 Oil return hose
82 Support for high-pressure oil pump
83 Hexagon screw with nut, washer, locking plate, and lock washer
84 Clamping screw
85 Narrow V-belt
86 Pulley

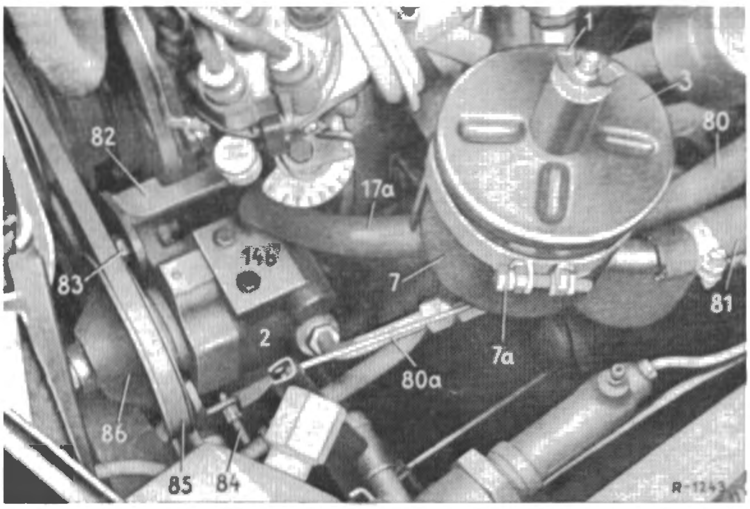


Fig. 46-21/2

Arrangement of high-pressure oil pump on Model 220 SEb

1 Wing nut
2 High-pressure oil pump
3 Cover
7 Reservoir
7a Hexagon screw on clamp
14b Flange plate
17a Connecting hose
80 High-pressure oil hose
80a Elbow on high-pressure oil pump
81 Oil return hose
82 Support for high-pressure oil pump
83 Hexagon screw with nut, washer, locking plate, and lock washer
84 Clamping screw
85 Narrow V-belt
86 Pulley

In order to re-adjust the V-belt (85) loosen the three hexagon screws attaching the high-pressure oil pump to the support, then tighten the hexagon nuts on the clamping screw (84) until the prescribed tension of the V-belt is obtained. Then re-tighten the hexagon screws (Figs. 46-21/1 and 46-21/2).

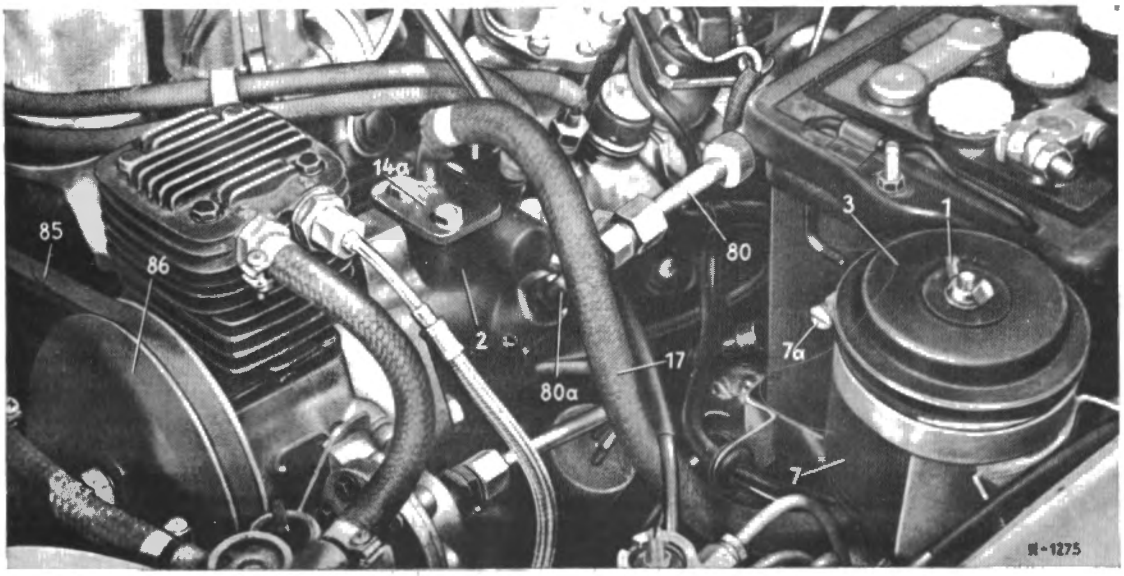


Fig. 46-21/3

Arrangement of high-pressure oil pumpon Model 300 SE

1	Wing nut	17	Connecting hose
2	High pressure oil pump	80	High-pressure oil hose
3	Cover	80a	Elbow on high-pressure oil pump
7	Reservoir	85	Narrow V-belt
7a	Hexagon screw on clamp	86	Pulley
14a	Flange plate		

In order to re-adjust the V-belt loosen the hexagon nut (97) on the clamping screw (96), then tighten the clamping screw until the prescribed V-belt tension has been obtained. Then re-tighten the hexagon nut (Fig. 46-21/4).

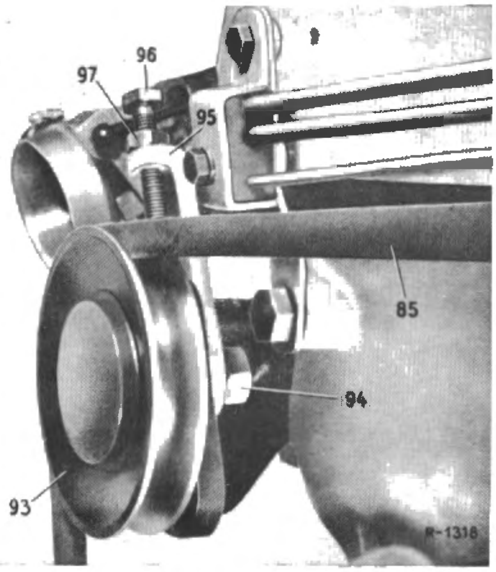


Fig. 46-21/4

85 Narrow V-belt
93 V-belt pulley
94 Hexagon nut
95 Tension bracket
96 Clamping screw
97 Hexagon nut

2. **Whenever the car is being serviced** check the two hose lines between the steering housing and the high-pressure oil pump and the connections for leaks.

3. Under normal circumstances the oil level in the reservoir of the high-pressure oil pump should be checked **after a mileage of 3000 km.** The oil level must be checked at operating temperature (approx. 80° C).

To do this loosen the wing nut and remove the screw cover. The oil level should reach the mark stamped in the reservoir (approx. 12 mm below the reservoir edge). For topping up use only the types of oil listed in our fuel and oil tables (maximum reservoir capacity 450 cc).

The oil level check must be made with the engine running.

4. **Caution:** In our works the system is filled with a special oil. When the system is installed subsequently and when the high-pressure oil pump or the power-steering has been repaired, it is imperative that one of the special oils listed in our fuel and oil tables should be used.
For ordinary servicing purposes the oil level can be topped up with automatic transmission fluid SAE type A.

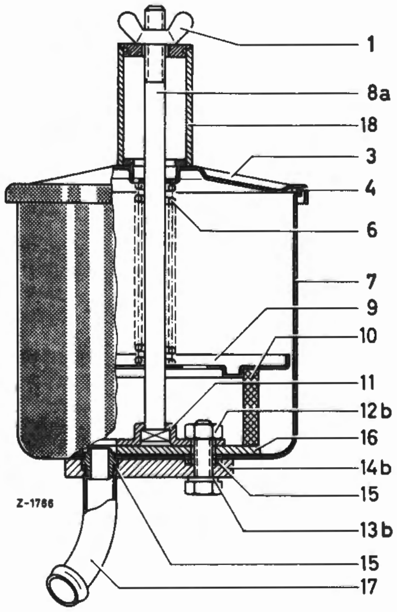


Fig. 46-21/5

1 Wing nut
3 Cover
4 Gasket
6 Pressure spring
7 Reservoir
8a Screw
9 Baffle plate
10 Filter element
11 Supporting bracket
12b Hexagon screw with nut
13b Sealing ring
14b Flange plate
15 O-ring
16 Reinforcement plate
17 Connecting pipe
18 Damping dome

5. **After a Mileage of 48 000 km** replace the filter element in the reservoir of the high-pressure oil pump.

To do this remove the cover, the pressure spring, the baffle plate and take out the filter element underneath. Install the new filter element, the baffle plate and the pressure spring. Check the oil level and, if necessary, top up. Fit the cover and tighten by means of the wing nut, using a new paper gasket.

Job No.
46-22

Bleeding of Power-Steering and High-Pressure Oil Pump

Note: Bleeding of the system is only necessary when the steering, the high-pressure oil pump or one of the oil hoses has been replaced or if the high-pressure oil pump has drawn in air because of too low an oil level in the reservoir.

1. Remove the cover of the reservoir (7), check the oil level and, if necessary, top up.

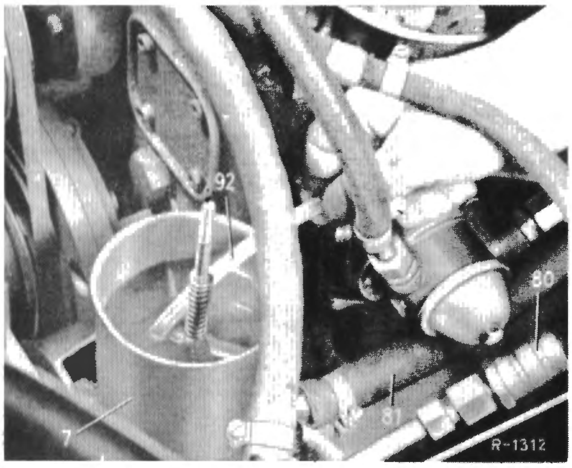


Fig. 46-22/1

7 Reservoir
80 High-pressure oil hose
81 Oil return hose
92 Bleeder hose

2. Check all connections between high-pressure oil pump and power steering for leaks.

Note: Even small leaks may cause early failure of the hydraulic assistance. Lack of oil may damage the high-pressure oil pump.

3. Push the bleeder hose (92) over the bleed screw of the power steering and insert the end of the hose in the reservoir (7) (Fig. 46-22/1).

4. Open the bleed screw approx. two turns. Run the engine at idle speed. Move the steering wheel several times to both sides no more than 1/4 of a turn from the center position.

Note: The bleeder hose must be held tightly at the bleed screw and in the reservoir. Otherwise it may twist away and cause large oil losses.

Checking of Power Steering and High-Pressure Oil Pump

Job No.
46-23

Modification: Para 4 in Section B added

Note: Before removing the steering or the high-pressure oil pump when the power steering is not functioning properly always check the system in the car. In most cases this check will show whether the fault is in the steering assembly or in the high-pressure oil pump and in this way unnecessary removal of the units can be avoided. In order to prevent damage to the high-pressure oil pump during checking operations the instructions given in Sections A and B should be followed very carefully.

A. Checking of Oil Pressure in the High-Pressure Oil Pump

Before checking the steering assembly itself for faults, always check the delivery pressure of the high-pressure oil pump first.

This can be done by connecting a pressure gage with throttle valve to the delivery side of the high-pressure oil pump. The delivery pressure is a safe indication of the functioning of the flow control valve and the pressure relief valve.

Note: At a counter pressure of 50 atm and at 500 rpm the minimum delivery of the pump should be 5.7 l/min. However, these values can only be measured on a test stand.

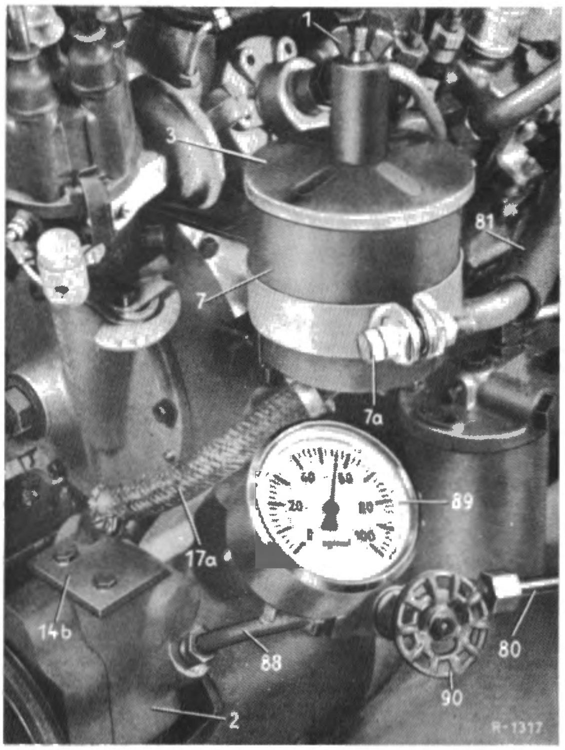


Fig. 46-23/1

1	Wing nut	17a	Connecting hose
2	High-pressure oil pump	80	High-pressure oil hose
3	Cover	81	Oil-return hose
7	Reservoir	88	Elbow
7a	Hexagon screw on clamp	89	Pressure gage
14b	Flange plate	90	Throttle valve

1. Empty the reservoir by means of a gun since otherwise oil will run out when the high-pressure oil hose is disconnected.

2. Disconnect the high-pressure oil hose (80) from the elbow. Connect the pressure gage (89). Close the throttle valve (90) on the pressure gage.

3. Fill up the reservoir, using only new oil.

4. Run the engine and measure the pressure at a speed of approx. 700 to 800 rpm. Keep the engine at this speed by working the accelerator.

The minimum delivery pressure should be 55 atm and the maximum 65 atm. Caution: Do not run the engine during this checking procedure for too long since otherwise the oil temperature will increase excessively and may damage the high-pressure oil pump.

If the pressure in the oil pump does not reach the prescribed value, it is advisable

to check and, if necessary, replace the flow control and pressure relief valves before removing and disassembling the pump.

5. Remove the pressure gage, connect the high-pressure oil hose and fill up the reservoir. Bleed the system (see Job No. 46-22).

B. Checking of Beginning of Manual Power Limitation

If the control slide valve works properly the force to be applied at the circumference of the steering wheel is limited to approx. 2.6-2.8 kg. The proper functioning of the manual power limitation can be measured in the car by means of a spring scale or a torque wrench. Since the spring scale can only be hooked over a spoke of the steering wheel the force measured at the spoke must be slightly lower than the force on the circumference of the steering wheel.

1. Run the engine and keep it at a speed of approx. 700 to 800 rpm during the measuring procedure.
2. Hook the spring scale (3) over one of the two steering wheel spokes and turn the wheel while holding the gage at an angle of 90° (Fig. 46-23/2).

Note: The spring scale must be hooked over the spoke at a distance of 190 mm measured from the center of the steering wheel. In order to prevent the scale from sliding on the fillet radius of the spoke it is advisable to apply some adhesive tape to this section of the spoke.

3. **When the manual power limitation works properly the force necessary to turn the stering wheel should not exceed 3.5 kg.**

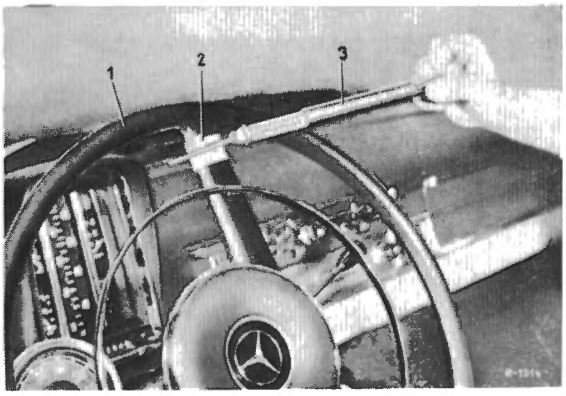


Fig. 46-23/2

1 Steering wheel 2 Adhesive tape 3 Spring scale 000 589 02 65

4. When Torque Wrench 000 589 67 21 is used to measure the manual power limitation remove the hub pad from the steering wheel. Then put the torque wrench on the hexagon nut of the steering tube and measure the force necessary to turn the steering tube; this force should not exceed 60-80 cmkg.

Trouble-Shooting Hints for the Power Steering and the High-Pressure Oil Pump

Job No.
46-24

A. High-Pressure Oil Pump

Trouble	Causes	Remedy
Tendency of steering wheel to make bumping and jerking movements when turned	V-belt to high-pressure oil pump too loose	Re-tension V-belt
Droning or grunting noise when wheel is turned	Lack of oil which causes the high-pressure oil pump to draw in air	Before topping up the reservoir with new oil find the leak in the hydraulic system. To do this turn the steering for a moment to the left and to the right in order to produce maximum pressure. If the system is heavily oiled up, thoroughly clean the parts with gasoline. Bleed the whole system after sealing the leak.
Foaming in the reservoir of the high-pressure oil pump	High-pressure oil pump draws in air	Replenish the oil **Models 220 b, 220 Sb** Replace the O-ring on the pipe union of the reservoir and the O-rings sealing the reservoir against the pump housing (see Job No. 46-28) **Models 220 SEb, 300 SE** Replace the O-rings between the flange plate and the pump housing (see Job No. 46-28) Check the hose connection between the reservoir and the high-pressure oil pump for leaks **Note:** Replace all aluminum sealing rings whenever the hexagon screws have been unscrewed
Oil pressure of high-pressure oil pump too low	Leaks in the hydraulic system	Check all pipe connections and the power steering for leaks
Oil pressure of high-pressure oil pump too low	Flow control valve sticking	**Models 220 b, 220 Sb, 220 SEb** Remove the high-pressure oil pump, remove the flow control valve and free up (see Job No. 46-28) **Model 300 SE** Drain the oil from the high-pressure oil pump, remove the flow control valve, free it up and, if necessary, replace it
High-pressure oil pump not delivering oil	High-pressure oil pump damaged	Remove high-pressure oil pump and disassemble. If wear is excessive, replace the pump **Note:** If the cam ring and the pump vanes show signs of damage, the steering assembly must be disassembled and cleaned and all hoses must be cleaned as well. Abrasive particles in the lines may cause failure of hydraulic assistance
Oil overflow in the reservoir on Model 300 SE	Leak in the sealing ring on the drive shaft which permits engine oil to flow from the air compressor into the high-pressure oil pump	Replace the housing cover of the high-pressure oil pump Remove the steering and drain the old oil by tilting the pipe connection

Trouble	Causes	Remedy
Lack of oil in reservoir	Reservoir cover not seated properly	Replace paper gasket and properly mount reservoir cover
	Reservoir shows cracks	Replace reservoir
	Models 220b, 220Sb, 220SEb Sealing ring on pump drive shaft leaking	Check alignment of pulley from high-pressure oil pump to crankshaft and adjust. Then replace housing cover and drive shaft

B. Steering

Trouble	Causes	Remedy
Steering too stiff when parking	Beginning of manual power limitation too late	Check beginning of manual power limitation if necessary, repair steering assembly, replacing control slide valve and bushing
	High-pressure oil pump not working properly	Check high-pressure oil pump and, if necessary, replace
	Lack of oil	Fill up oil reserve, if necessary, find leakage and seal
	Air trapped in the system	Bleed system
	V-belt to high-pressure oil pump loose	Re-tension V-belt
	Control slide valve sticking because of dirt	Remove steering assembly, disassemble and clean, free up control slide valve in the bushing and, if necessary, replace
	Excessive friction between steering nut and power piston	Disassemble, check, and repair steering assembly (see Job No. 46-27) **Note:** If abrasive particles are found, disassemble and check the high-pressure oil pump, if necessary, replace it
	Internal leakage in steering assembly	Remove and disassemble steering assembly, replace all seals (O-rings, Teflon inner sealing ring)
Steering does not return easily to center position after having been turned	Steering shaft adjusted too tightly	Remove steering assembly and re-adjust pressure block assembly
	Control slide valve sticking because of dirt	Remove steering assembly, disassemble and clean
	Steering nut sticking because of dirt in power piston	Remove steering assembly, disassemble and clean
	Centering spring broken	Disassemble steering assembly, replace centering spring
Rattle in the steering	Excessive play between control edge of steering nut and control slide valve	Replace steering nut, steering worm and control slide valve with bushing
Knocking of steering in center position	End play between steering worm and bearing cap	Remove steering and replace axial bearings in bearing cap
	End play of steering nut in power piston	Remove steering and replace axial angular contact bearings
Knocking in the steering when wheel is turned	Steering shaft lifting from power piston	Remove steering, re-adjust pressure block assembly

Trouble	Causes	Remedy
Squeaking of steering when turned	Scoring of ball-head of steering shaft in ball socket of power piston	Remove steering and repair or replace steering assembly
Leak in steering assembly	Leaking sealing ring on steering shaft	Remove steering, remove lower housing cover and replace sealing ring
	Leaking sealing ring in bearing insert	Remove steering and replace ring in bearing insert
	Leaking O-rings on bearing cap	Remove steering, unscrew bearing cap, turn steering to the right up to the point where bearing cap is pushed out of the steering housing and replace O-rings
	Leaking O-rings in lower housing cover	Remove steering, remove lower housing cover and replace O-rings
	Leaking O-ring on pressure union	Unscrew pressure union and replace O-ring
	Leaking O-ring on round nut	Remove steering. Unscrew round nut and replace O-ring. Re-adjust pressure block assembly **Note:** Replace all aluminum sealing rings under hexagon nut and cap nut
	Leaking brass cone in pressure union	Replace pressure union
	Leaking sealing ring below screw plug or return union	Unscrew screw plug or return union and replace sealing ring
Temporary stiffness of steering when wheel is turned quickly	Air trapped in system	Bleed system

Job No.
46-25

Removal and Installation of Power Steering

Removal:

1. Draw the oil from the reservoir of the high-pressure oil pump by means of a gun.

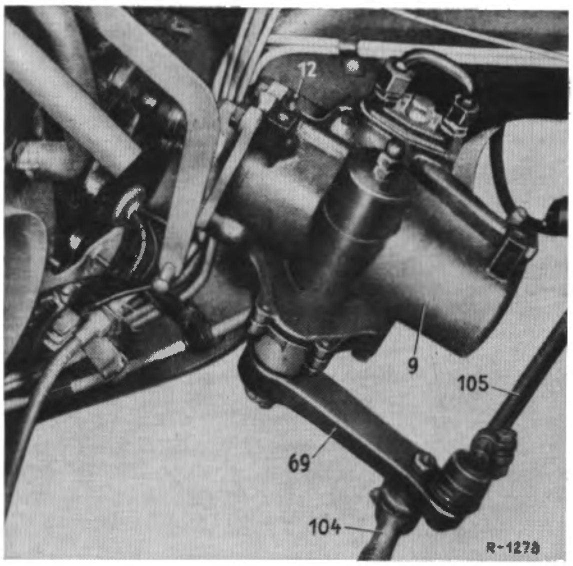


Fig. 46-25/1

9 Steering assembly
12 Bleed screw
69 Steering gear arm
104 Center tie-rod
105 Left tie-rod

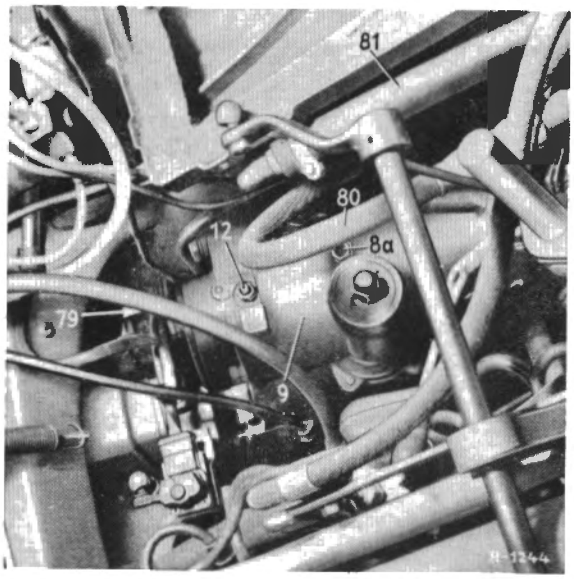


Fig. 46-25/2

8a Center position check screw 111 589 02 23 00
9 Steering housing
12 Bleed screw
79 Hexagon socket screw (clamping screw)
80 High-pressure oil hose
81 Oil-return hose

2. Detach the high-pressure oil hose (80) and the oil-return hose (81) from the steering assembly, holding the connectors on the steering assembly steady (Fig. 46-25/2).

3. Cover the oil hoses and the connecting points of the power steering with dust caps to prevent dirt from entering the system.

4. Unscrew the hexagon screw (79) from the lower flange of the steering coupling (Fig. 46-25/2).

5. Press the center tie rod off the steering gear arm using Fixture 111 589 08 33 (Fig. 46-25/3).

6. Press the tie-rod off the steering gear arm using Fixture 186 589 10 33 (Fig. 46-25/4).

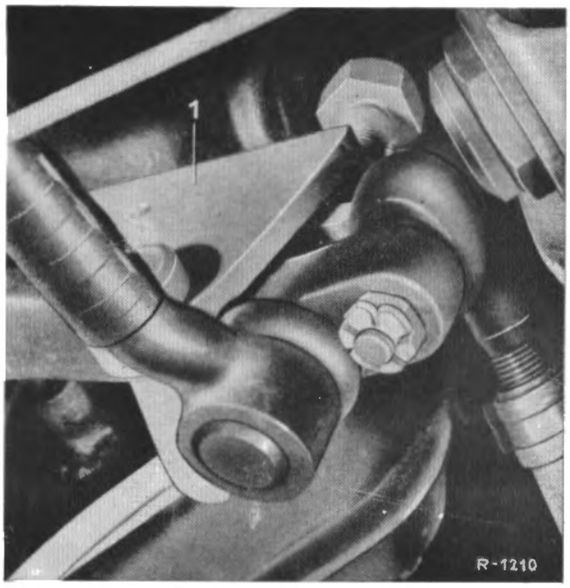


Fig. 46-25/3

1 Fixture 111 589 08 33

Note: The tie-rod can also be pressed off by means of Fixture 136 589 12 33.

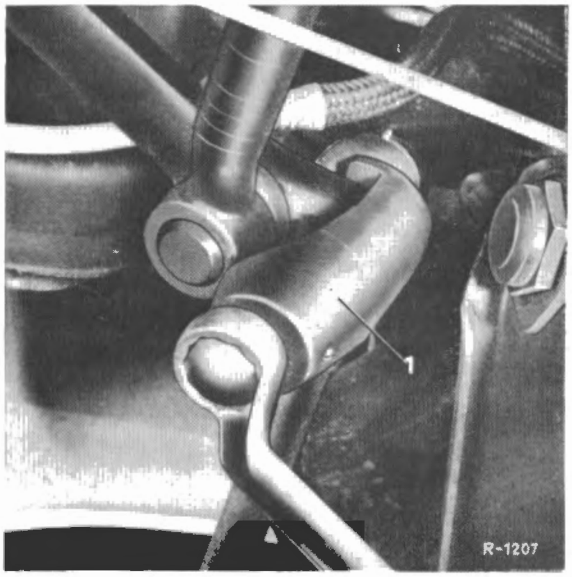


Fig. 46-25/4

1 Fixture 186 589 10 33

7. Unscrew the hexagon screws for fastening the steering assembly to the chassis base panel. Then press the steering worm off the steering coupling and remove the steering assembly downward.

8. Drain the oil from the steering assembly by holding the steering assembly with the oil union downward and by turning it hard over to the left and to the right.

Installation:

9. Check the steering coupling. If necessary, remove the coupling from the steering tube and reinstall after repair (see Job No. 46-13).

10. Install the steering gear arm on the steering shaft paying attention to the position markings on the steering gear arm and the steering shaft. Tighten the castle nut with approx. 15 mkg and cotter.

11. Unscrew the screw plug from the steering assembly. Put the steering assembly in center position. Fix the power piston in position in the steering housing by screwing in the center check screw.

Note: Before screwing in the check screw, turn the steering worm until the center of the power piston is exactly below the threaded bore in the steering housing.

12. Check dimension 'a', if necessary adjust by changing the position of the steering gear arm (Fig. 46-25/5 and Job No. 46-0).

13. Put the steering tube (19) in its center position. In this center position the canceling cam (13) on the steering tube is opposite the center of the flash signal switch (18). For inspection purposes remove the rubber cover (17) for the flash signal switch from the steering column jacket (see Fig. 46-7/3).

14. Press in the steering worm into the steering coupling taking care to ensure that the serrations are not damaged and that the steering tube remains in its center position.

15. Attach the steering assembly to the chassis base panel. Insert the lower hexagon socket screw (clamping screw) into the steering coupling and tighten it (Fig. 46-25/1).

16. Unscrew the center check screw and screw the screw plug into the steering housing using a new sealing ring.

17. Attach center tie-rod and tie-rod to the steering gear arm (see Job No. 46-9).

18. Turn the steering hard over to the left and to the right. In doing this check whether the steering knuckle arm rests against the steering knuckle assembly stop face (see Fig. 46-1/3).

Note: The steering must be limited by the steering knuckle assembly.
If this is not the case, the cause may be an incorrectly installed steering gear arm or toe-in maladjusted on one side. For this reason it is important to adjust the toe-in with the steering wheel in the center position, so that the toe-in on the left and on the right wheel is evenly distributed.

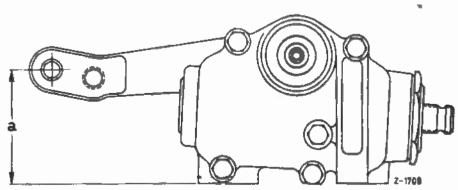


Fig. 46-25/5

19. Remove the dust cap from the pressure and return union. Connect the high-pressure and return hoses to the upper housing cover of the power steering.

Note: Make sure that the hoses are properly positioned. Even minor rubbed spots may cause oil loss in a very short time and as a consequence may produce failure of hydraulic assistance.

20. Fill up the reservoir of the high-pressure oil pump with the prescribed type of oil (see fuel and oil tables).

21. Push the bleed hose on to the bleed valve of the power steering. Back off the screw and insert the bleed hose in the reservoir.

22. With the engine running bleed the hydraulic system of the power steering and replenish the oil in the reservoir of the high-pressure oil pump up to the oil level mark (see Job No. 46-22).

Note: During the bleeding procedure hold the bleed hose steady. Run the engine only for a short time in order to prevent emptying of the reservoir. Always replenish the oil in the reservoir immediately.

23. Check the hydraulic system and the power steering for leaks.

Note: With the engine running turn the steering to right or left lock for a short time in order to ensure that maximum oil pressure is reached. Then check whether all connection points are absolutely leakproof.

24. Adjust the toe-in.

25. Check the position of the steering wheel during the trial run. When the wheels are in the straight ahead position, the steering wheel must be in the dead center position.

26. Check whether the automatic return mechanism of the flash signal switch is working properly.

Removal and Installation of High-Pressure Oil Pump

Job No.
46-26

Models 220 b, 220 Sb and 220 SEb

Note: On Models 220 b and 220 Sb the reservoir is screwed to the high-pressure oil pump, whereas on Models 220 SEb and 300 SE the reservoir is separated from the high-pressure oil pump.

Removal:

1. Unscrew the wing nut (1) on the reservoir (7) and remove the cover together with the gasket. Remove the pressure spring, the baffle plate and the filter element from the reservoir (Figs. 46-26/1 and 46-26/3).

2. Empty the reservoir by means of a gun since otherwise it will be difficult to collect the oil when disconnecting the hoses.

3. Unscrew the hexagon nut from the drive shaft of the high-pressure oil pump, holding the pulley (86) steady at the parallel flat (Fig. 46-26/2).

4. Loosen the hexagon nuts fastening the high-pressure oil pump to the support (82) without, however, unscrewing the nuts completely (Figs. 46-26/1 and 46-26/3).

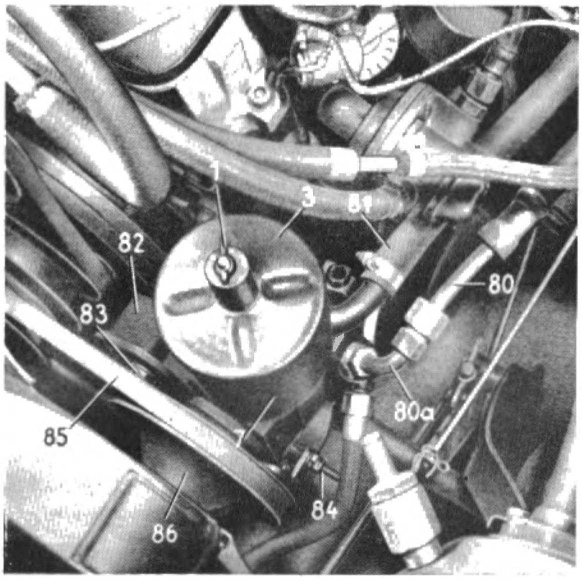


Fig. 46-26/1

Arrangement of high-pressure oil pump and reservoir on Models 220b and 220 Sb

1 Wing nut
3 Cover
7 Reservoir
80 High-pressure oil hose
80a Elbow on high-pressure oil pump
81 Oil return hose
82 Support for high-pressure oil pump
83 Hexagon screw with nut, washer, locking plate and lock washer
84 Clamping screw
85 Narrow V-belt
86 Pulley

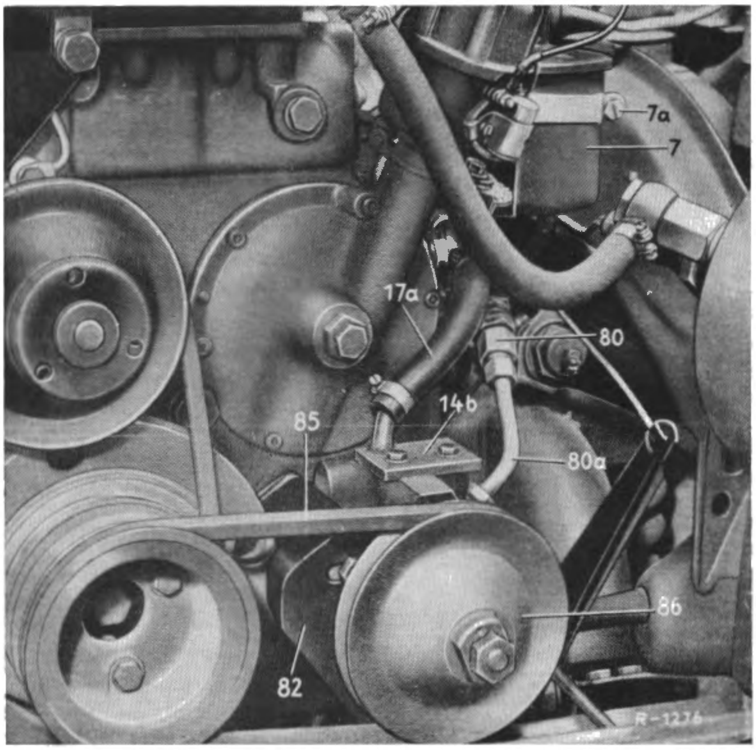


Fig. 46-26/2

Arrangement of high-pressure oil pump and reservoir on Model 220 SEb

7 Reservoir
7a Hexagon screw on clamp
14b Flange plate
17a Connecting hose
80 High-pressure oil hose
80a Elbow on high-pressure oil pump
82 Support for high-pressure oil pump
85 Narrow V-belt
86 Pulley

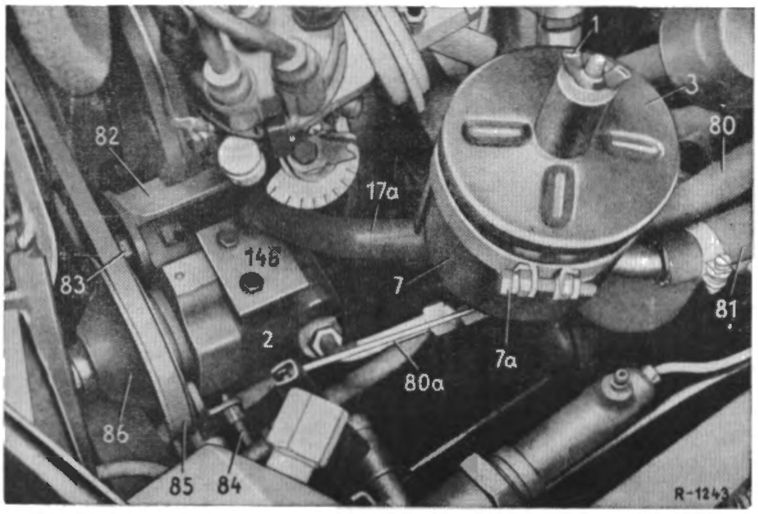


Fig. 46-26/3

Arrangement of high-pressure oil pump and reservoir on Model 220 SEb

1 Wing nut
2 High-pressure oil pump
3 Cover
7 Reservoir
7a Hexagon screw on clamp
14b Flange plate
17a Connecting hose
80 High-pressure oil hose
80a Elbow on high-pressure oil pump
82 Support for high-pressure oil pump
83 Hexagon screw with nut, washer, locking plate and lock washer
84 Clamping screw
85 Narrow V-belt
86 Pulley

5. Loosen the hexagon nuts on the clamping screw (84) until the V-belt is slack and remove the V-belt from the pulley (Fig. 46-26/2).

6. Disconnect the high-pressure oil hose (80) from the pipe elbow (80a). Carefully plug the hose and the connection on the housing to prevent dirt from entering.

7. On Models 220 b and 220 Sb disconnect the return hose (81) from the reservoir (Fig. 46-26/1). On Model 220 SEb disconnect the connecting hose (17a) (Figs. 46-26/2 and 46-26/3) from the reservoir to the high-pressure oil pump at the pipe elbow on the pump housing. Carefully plug the connecting points to prevent dirt from entering.

8. Unscrew the hexagon screws. Remove hexagon nuts, clamping screw, locking plates and spacer ring. Remove the high-pressure oil pump from the support.

Installation:

9. Put the pulley on the drive shaft, then fit the high-pressure oil pump (2) to the support (82) and attach by means of the hexagon screws in such a way that the oil pump can still move easily in the support.

Note: a) To begin with attach the high-pressure oil pump by means of the hexagon screws to the front face of the support.

b) The locking plates prevent the hexagon nuts, which are not easily accessible, from turning.

c) Use the lower hexagon screw on the front face to fasten the clamping screw.

d) Do not omit the spacer ring between the support and the high-pressure oil pump at the rear attachment point. The spacer ring prevents undue strain on the high-pressure oil pump in the support and is available in the following thicknesses: 13.5; 13.25; 13.0; 12.75; 12.5 mm.

e) The rear hexagon screw has a standard Witworth thread.

10. Attach the pulley to the drive shaft of the high-pressure oil pump. Put on the narrow V-belt and tension it by means of the tensioning device until the belt can be depressed approx. 10 mm. Tighten the hexagon nuts on the clamping screw.

11. Tighten the hexagon nuts fastening the high-pressure oil pump to the support.

12. Connect the high-pressure oil hose to the pump.

13. On Models 220 b and 220 Sb connect the oil return hose to the reservoir. On Model 220 SEb connect the connecting hose from the reservoir to the high-pressure oil pump.

14. Insert the filter element, the baffle plate and the pressure spring in the reservoir, fill the reservoir with the prescribed type of oil (see fuel and oil tables) and bleed the system (see Job No. 46-22).

Note: When filling up with oil it is advisable to top up the oil in the reservoir when the engine is being started in order to ensure that the pump does not draw in air.

15. Put the cover and gasket on the reservoir and screw down by means of the wing nut.

16. Check the high-pressure oil pump and all hose connections for leaks.

Note: With the engine running turn the steering to right or left lock for a shorts time in order to ensure that maximum oil pressure is reached.

Model 300 SE

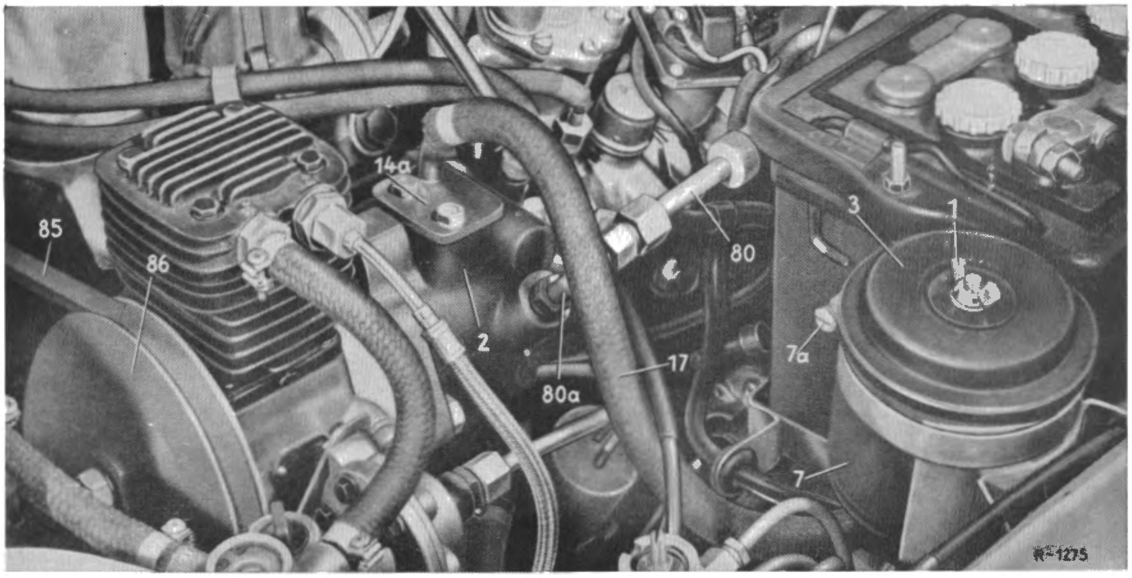


Fig. 46-26/4

Arrangement of high-pressure oil pump and reservoir on Model 300 SE

1	Wing nut
2	High-pressure oil pump
3	Cover
7	Reservoir
7a	Hexagon screw on clamp
14a	Flange plate
17	Connecting hose
80	High-pressure oil hose
80a	Elbow on high-pressure oil pump
85	Narrow V-belt
86	Pulley

Removal:

1. Disconnect the high-pressure oil hose (80) and the connecting hose (17) from the high-pressure oil pump (2) (Fig. 46-26/4).
2. Remove the air compressor (see Job No. 32-15).
3. Unscrew the hexagon socket screws attaching the high-pressure oil pump (2) to the air compressor (Fig. 46-26/5).
4. Remove the O-ring (15a) from the pump housing (15) (see Fig. 46-28/11).

Installation:

5. Put a new O-ring (15a) in the pump housing (15) (see Fig. 46-28/11).
6. Attach the high-pressure oil pump to the air compressor; the tightening torque of the screw connection is 4–5 mkg.

Note: When attaching the pump to the air compressor make sure that the projections of the drive shaft fit accurately into the slots of the coupling disk.

7. Install the air compressor and the high-pressure oil pump (see Job No. 32-15).
8. Attach the high-pressure hose and the connecting hose to the high-pressure oil pump.
9. Remove the cover (3) from the reservoir (7) and top up with oil up to the mark and bleed the system (see Fig. 46-26/4 and Job No. 46-22).

Note: When filling up with oil it is advisable to top up the oil in the reservoir when the engine is being started in order to ensure that the pump does not draw in air.

10. Check the high-pressure oil pump and all hose connections for leaks.

Note: With the engine running turn the steering for a moment to left or right lock in order to obtain maximum oil pressure.

Fuel System — Group 47

Exhaust System — Group 49

Cooling System — Group 50

Job No.
47-0

Fuel System

General Data, Dimensions, and Tolerances

Modification: Models 230 SL, 300 SE (2nd Version) added

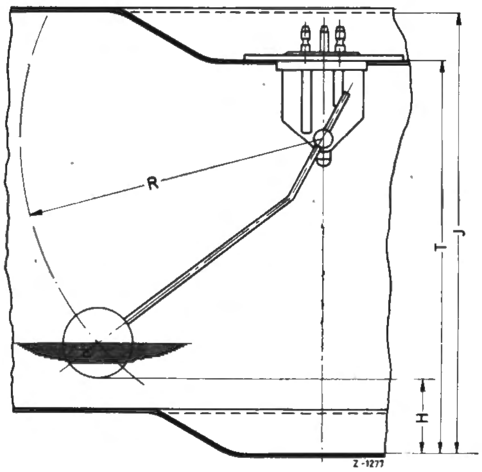


Fig. 47-0/1

Fuel Tank and Fuel Level Indicator

Model	Installation height 'T' mm	Height of tank 'J' mm	Length of lever 'R' mm	Lever position mm	Resistance ohm	Fuel gage	Tank contents[1]) available[2])
190 c 190 Dc 220 b (1st version)	142	164	104	$H = 23$	10±4	reserve	5
				$H_1 = 25$	—	warning light	6
				$H_2 = 44$	50±5	¼	12.8
				$H_3 = 74$	100,5±5	½	25.5
				$H_4 = 102$	143±6	¾	38
				$H_5 = 129$	$180\,^{+12}_{-\,2}$	full	51
220 b[3]) (2nd version) 220 Sb 220 SEb 230 SL 300 SE (1st version) 300 SE (2nd vers.)[1])[3])	180	199	132	$H = 33$	10±4	reserve	7(9)[1])
				$H_1 = 35$	—	warning light	8(10)
				$H_2 = 58$	50±5	¼	16(20)
				$H_3 = 95$	100,5±5	½	32(40)
				$H_4 = 130$	143±6	¾	48(60)
				$H_5 = 164$	$180\,^{+12}_{-\,2}$	full	64(80)

[1]) The values in brackets apply to the 82 liter fuel tank of Model 300 SE.
[2]) In the case of Models 190 c, 190 Dc and 220 b 1st version the actual contents of the fuel tank is 52 liters, but a residual amount of 1 liter is not available because of impurity deposition. On Models 220 b 2nd version, 220 Sb, 220 SEb, 230 SL, and 300 SE 1st version with a fuel tank capacity of 65 liters, 1 liter is not available, and on Model 300 SE 2nd version with a fuel tank capacity of 82 liters a residual amount of 2 liters is not available.
[3]) The larger fuel tanks can be installed subsequently.

Note: With the float lever in position 'H_1' the warning light must light up after a switch-on lag of 4—7 minutes. The delay in the lighting up of the warning light is caused by bi-metal springs built into the fuel gage.

Removal and Installation of Fuel Tank

Job. No.
47-1

Modification: Fuel Tank with Hose Connections (Addition)

Removal:

1. Unscrew the screw plug from the fuel tank and empty the tank.

2. Pull out the plug for the electric cable at the fuel level indicator.

3. Take off the filler cap. On cars with fuel tank ventilation remove the vent lines from the filler neck.

4. Remove the fuel lines from the tank.

5. Unscrew the three hexagon nuts and remove the fuel tank.

Note: If soldering work has to be carried out on the new fuel tank the openings of the intake and return pipes must be carefully closed in order to ensure that the plastic hose inside the tank does not melt.

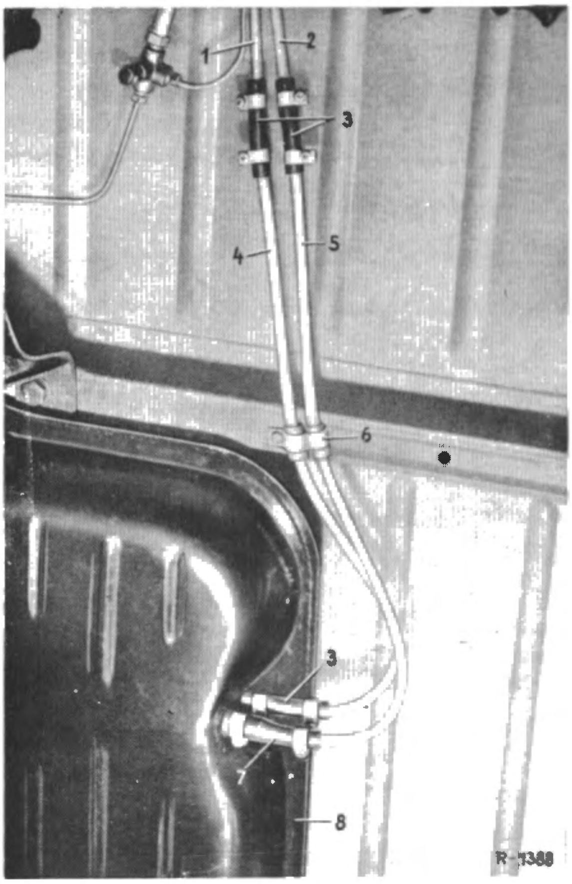


Fig. 47-1/1

Models 190 Dc, 220 b, 220 Sb

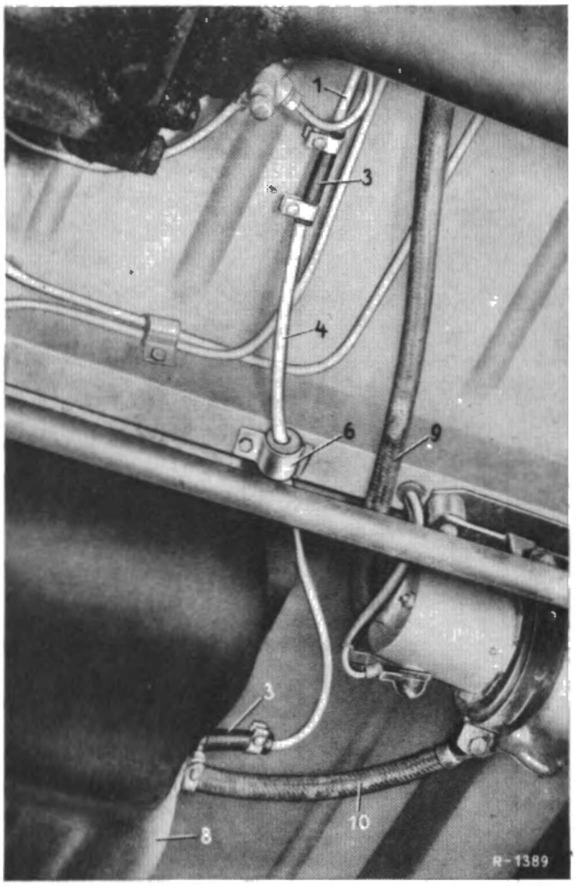
1 Fuel return line
2 Fuel intake line
3 Fuel hose
4 Additional fuel return line
5 Additional fuel intake line
6 Fixing clip
7 Fuel hose
8 Fuel tank

Installation:

6. When reinstalling the tank make sure that the felt strips on the upper surface of the tank are well cemented to the tank.
   If a **plastic screw plug** is installed in the fuel tank it should be tightened with a **torque wrench to 80–90 cmkg** (see Job-No. 47-3).

Note: On recent cars the fuel tank and the fuel lines have been provided with hose connections to replace the previous screw connections. Since only fuel tanks with hose connections are supplied as replacement parts it is necessary when installing a new fuel tank in an older car to saw off the fuel lines, to debur them, to blow them through from in front and to supplement them with additional lines (see Figs. 47-1/1 and 47-1/2).

The additional fuel lines (4) and (5) are attached to the cross member by means of the fixing clip (6) and they are positioned in such a way that the lines to the pipe unions on the fuel tank and to the fuel lines (1) and (2) are properly aligned. The fuel hoses must not rub anywhere and must on no account be kinked. If necessary the lines must be bent (Figs. 47-1/1 and 47-1/2).



On Model 190 c the connection for the fuel return line on the fuel tank is closed by a cover.

On Model 220 SEb the fuel hose (10) between fuel tank and electric feed pump must be replaced (Fig. 47-1/2).

Fig. 47-1/2

Model 220 SEb

1 Fuel return line
3 Fuel hose
4 Additional fuel return line
6 Fixing clip
8 Fuel tank
9 Fuel hose from feed pump to fuel intake line
10 Fuel hose from fuel tank to feed pump

Job. No.
47-2

Removal and Installation of Fuel Level Indicator

Removal:

1. Take out the rubber mat in the trunk compartment and remove the rubber cap from the floor of the trunk compartment.

2. Pull out the plug from the fuel level indicator. Unscrew the fixing nuts and remove the fuel level indicator.

3. Remove the gasket from the fuel tank, taking care to ensure that no worn parts of the gasket fall into the fuel tank.

Installation:

4. Slightly coat a new gasket with Sealing Compound Teroson LB 1020/1 on one side and put it on the tank in such a way that the coated side lies on the fuel tank. Coat the fuel level indicator slightly with sealing compound and install it, then tighten the fixing nuts crosswise.

Note: It is very important that the sealing compound mentioned above should be used because it is resistant to alcohol and gasoline. All other sealing compounds are more or less soluble in gasoline and may therefore clog the filter. The fixing bores in the fuel level indicator are offset so that the fuel level indicator cannot be installed incorrectly.

Screw Plugs for the Fuel Tank

Job. No.
47-3

Modification: Plastic Screw Plug (Addition)

For the new fuel tanks the screw plugs are made of plastic. The screw plug filter consists of square 0.08 mm mesh on gasoline cars and 0.6 mm mesh on Diesel cars.

The screw plugs can be distinguished by the face inscription **"Benzin"** (gasoline) and **"Diesel".**

The plastic screw plugs should be tightened with a maximum torque of 80–90 cmkg. A lower torque will produce leaks and excessive torque may damage the thread of the screw plug.

Model 220 SEb

On Model 220 SEb the first version filter of the screw plug was made of filter-screen mesh which clogs very easily. When complaints are received about inadequate fuel supply due to the filter in the fuel tank this screw plug must be replaced by a second version screw plug Part No. 111 470 02 86. These two versions of the screw plug can easily be distinguished by holding them up against the light. The first version screw plugs with the filter of filter-screen mesh is opaque, whereas the second version is translucent (Fig. 47-3/2).

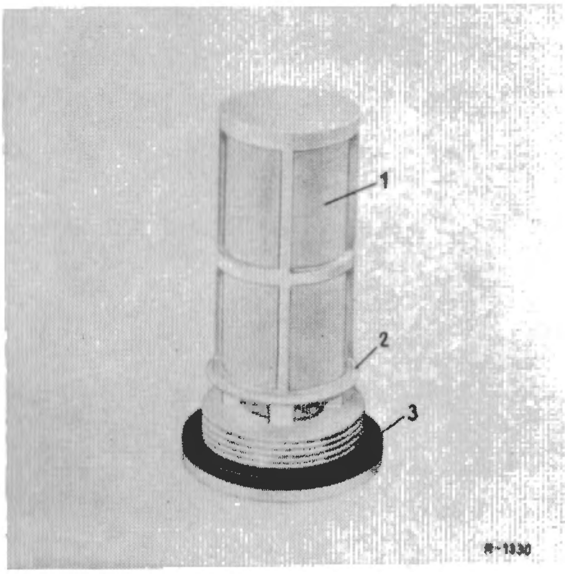
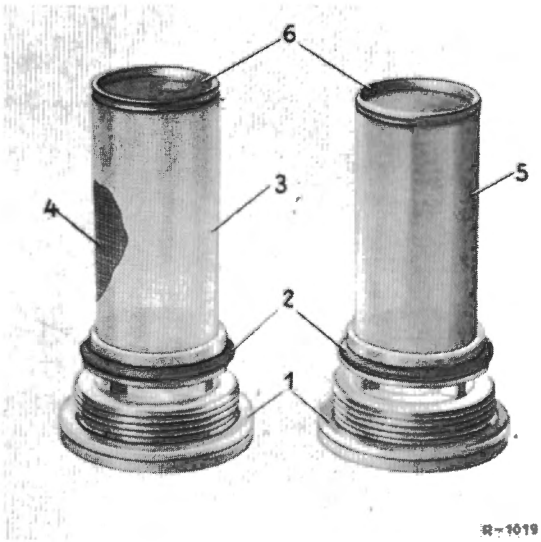


Fig. 47-3/1

Plastic Screw Plug

1 Screen jacket
2 Sealing lip
3 Sealing ring



1st version 2nd version

Fig. 47-3/2

Metal Screw Plug Model 220 SEb

1 Sealing ring
2 Rubber sealing ring
3 Screen jacket (Square-mesh gauze)
4 Supporting gauze
5 Screen jacket (filter-screen mesh)
6 Lid

Removal and Installation of Exhaust System

Job No.
49-1

Modification: Revised and extended

Removal:

1. Unscrew the exhaust pipe at the front of the exhaust manifold.

2. Unscrew the exhaust bracket (4) from the mounting plate (9) on the rear transmission housing cover (Fig. 49-1/1), and, if installed, detach the rubber rings (10) for fastening the exhaust line to the chassis base panel (Fig. 49-1/2).

3. On cars with air suspension detach the connecting rod for the level adjustment valve from the lever of the torsion bar on the rear axle and after loosening the lower clamp (5) fold down the torsion bar (2) (Fig. 49-1/3).

4. Detach the rubber rings (1) from the main muffler (4) (Fig. 49-1/4), and on cars with dual-pipe exhaust assembly unscrew the hexagon nuts (1) for fastening the main muffler (2) (Fig. 49-1/5).

5. Remove the complete exhaust system, paying attention to the insulating plates (3) between exhaust pipes and the rubber rings whenever installed (Fig. 49-1/5).

Note: The exhaust assembly consists of two parts with the exception of Model 230 SL. After loosening the clamping screws on the pipe clips the rear exhaust line can be removed together with the mufflers.

Installation:

6. Fix the front exhaust line loosely to the exhaust manifold.

7. Attach the rubber rings to the main muffler and on cars with dual-pipe exhaust system fit the insulating plates and screw on the hexagon nuts (Figs. 49-1/4 and 5).

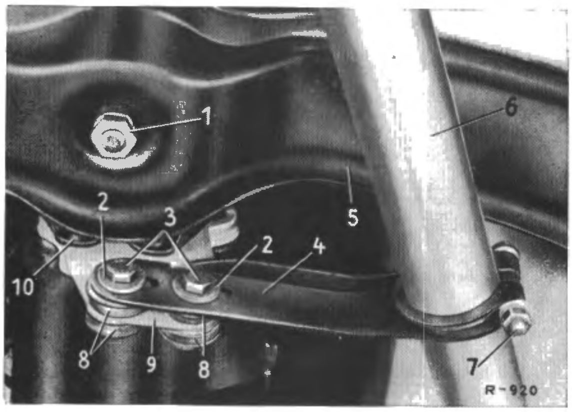


Fig. 49-1/1

1 Hexagon nut
2 Washer
3 Hexagon screw
4 Exhaust pipe bracket
5 Support
6 Exhaust pipe
7 Hexagon screw (clamping screw)
8 Rubber washer
9 Mounting plate
10 Engine support

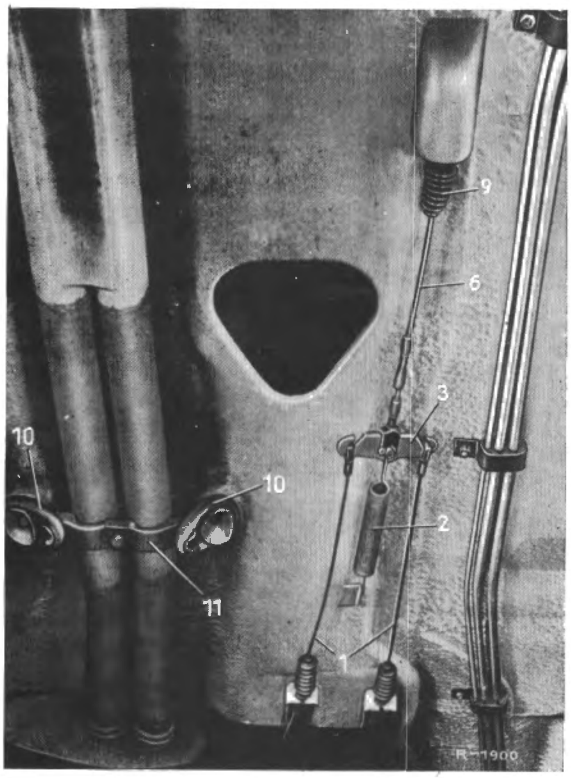


Fig. 49-1/2

1 Rear brake cable
2 Return spring
3 Equalizer
6 Front brake cable
9 Rubber grommet
10 Rubber ring
11 Lower bracket

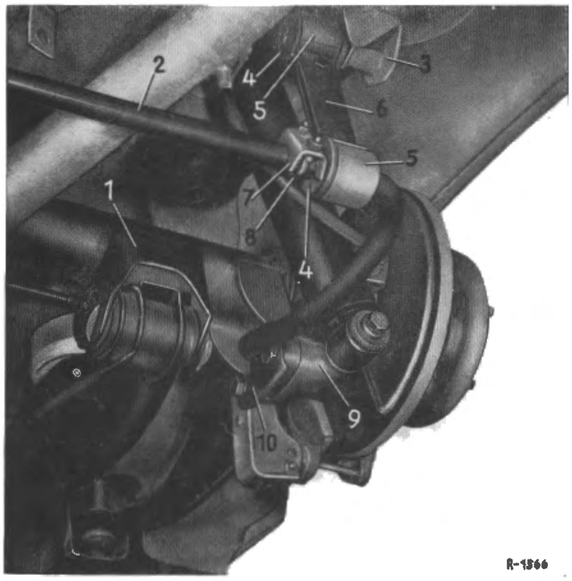


Fig. 49-1/3

1 Rear axle tube
2 Torsion bar
3 Chassis base panel bracket
4 Rubber mounting
5 Clamp
6 Bracket
7 Retainer
8 Fixing strap
9 Bearing bracket
10 Connecting link

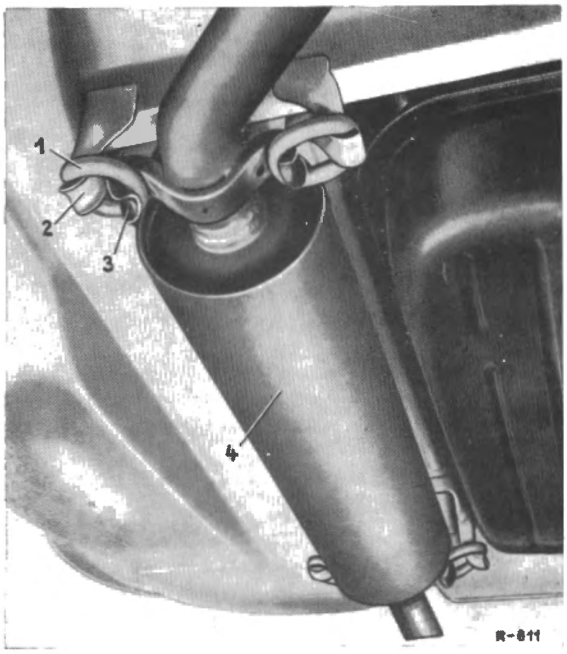


Fig. 49-1/4

1 Rubber ring
2 Chassis base panel bracket
3 Main muffler bracket
4 Main Muffler

8. Put new sealing rings on the front exhaust pipe and attach the pipe to the exhaust manifold with self-locking nuts.

9. Screw the exhaust pipe bracket to the mounting plate on the transmission in such a way that the exhaust system is mounted without any tension (Fig. 49-1/1). Where required attach the rubber rings (10) to the chassis base panel (Fig. 49-1/2).

10. On cars with air suspension fold the torsion bar (2) on the rear axle upward and attach the clamp (5) to the bracket (6) (Fig. 49-1/3). Attach the connecting rod for the level-adjustment valve to the lever of the torsion bar.

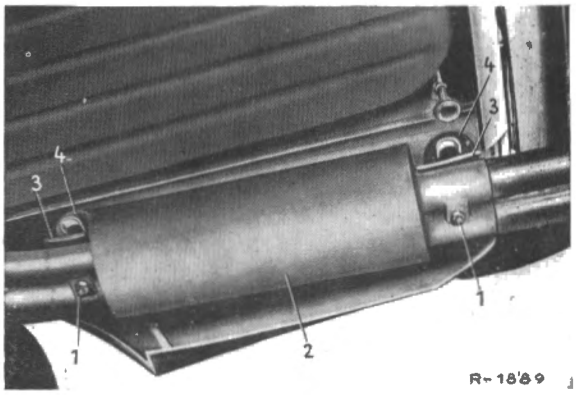


Fig. 49-1/5

1 Hexagon nut
2 Main muffler
3 Insulating plate
4 Rubber ring

Removal and Installation of Radiator

Job No.
50-1

Addition: Various versions of cooling water lines and installation instructions for radiators involved in accidents

Removal:

1. Remove the radiator cap.

Caution: Overpressure cooling system! The radiator cap must not be unscrewed unless the cooling water temperature is below 90° C. First turn the cap to notch 1 and allow the overpressure to escape. Then continue to unscrew and remove the cap.

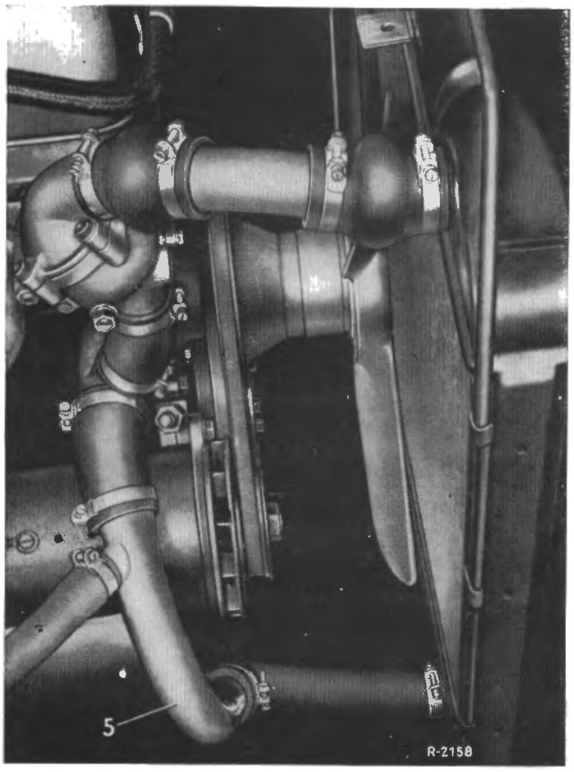


Fig. 50-1/1

Cooling water lines
1st version 220 b, 220 Sb, 220 SEb

5 Distributor pipe

2. Drain the cooling water at the radiator drain cock or the screw plug on the radiator and collect it because of such additives as anti-freeze etc.
   If the whole cooling water has to be drained, e. g., because pre-mixed anti-freeze has to be filled in, move the heater control levers to "warm" and unscrew the screw plug at the side of the engine block. This is the only way of draining the whole cooling system.

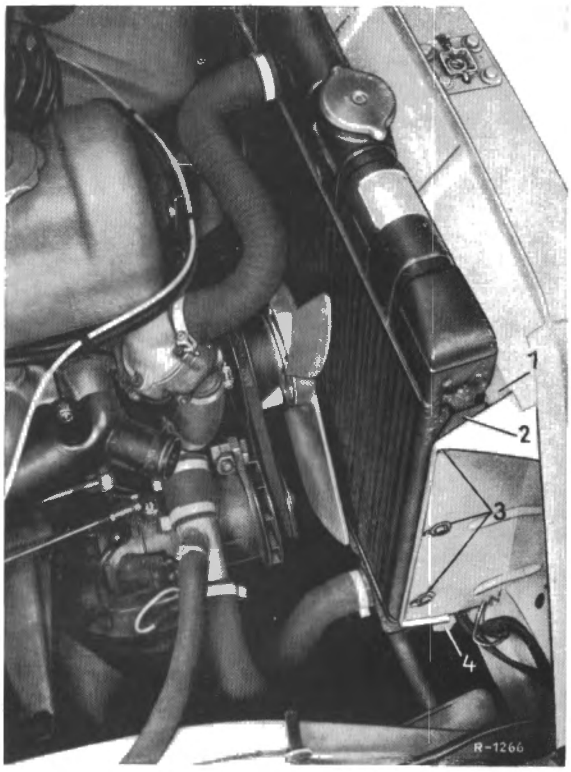


Fig. 50-1/2

Cooling water lines
1st version 190 c, 190 Dc
2nd version 220 b, 220 Sb, 220 SEb

1 Sealing strip (top)
2 Rubber pad
3 Hexagon screws
4 Sealing strip (bottom)

Note: Before screwing in the screw plug, clean the thread of the screw plug for the water tank or the engine block and coat it with graphite paste. Also install a new sealing ring (tightening torque for screw 0.6—0.8 mkg).

3. Unfasten the cooling water hose clamps at the top and at the bottom of the radiator and on Model 230 SL also detach the bleeder hose (5). Remove the water hoses from the pipe unions of the radiator (Figs. 50-1/2 to 5).

4. On cars with automatic DB transmission unscrew any hose connections from the transmission oil cooler (Fig. 50-1/6). Plug the pipe unions on the radiator and hose lines against dust.

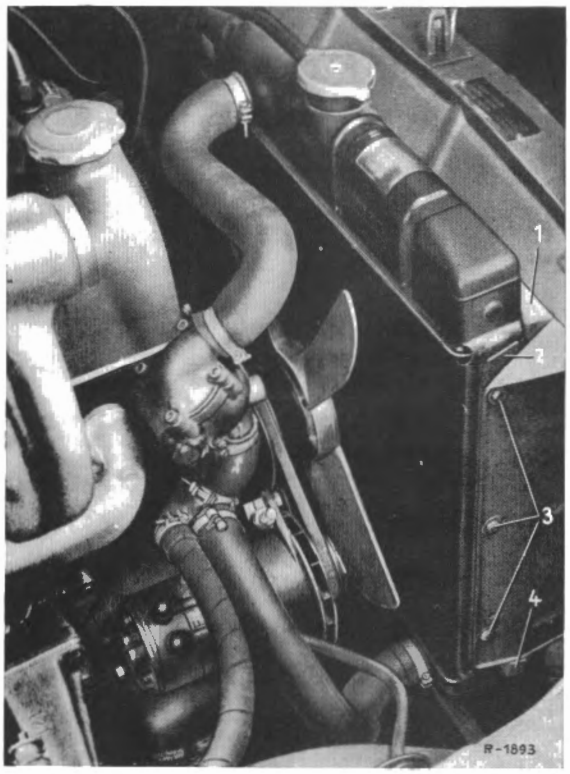


Fig. 50-1/3

Cooling water lines
2nd version 190 c, 190 Dc
3rd version 220 b, 220 Sb, 220 SEb

1 Sealing strip top
2 Rubber pad
3 Hexagon screws
4 Sealing strip bottom

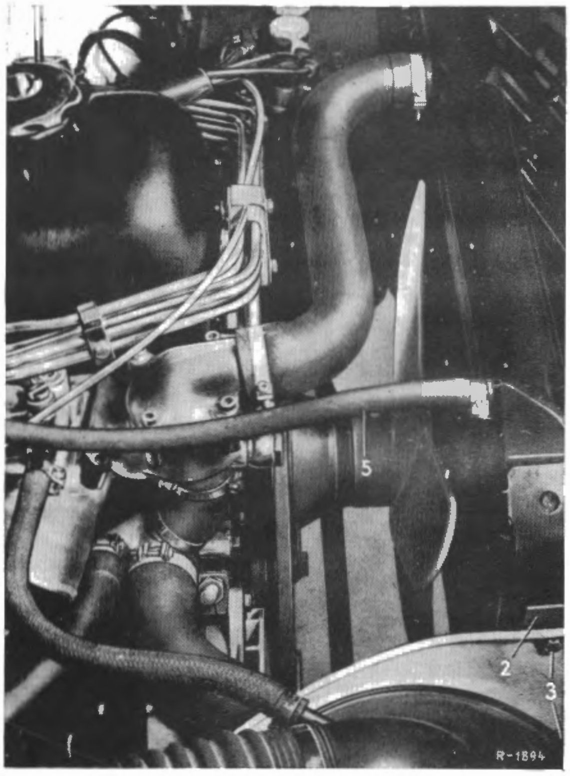


Fig. 50-1/4

Cooling water lines
230 SL

2 Rubber pad
3 Hexagon screws
5 Bleeder hose

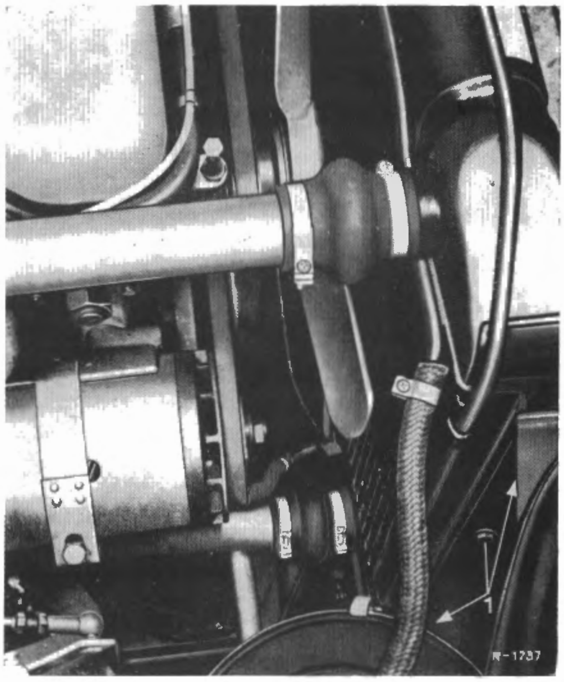


Fig. 50-1/5

Cooling water lines
300 SE

1 Fixing screws

5. Unscrew the side fixing screws (Figs. 50-1/2 to 5). On Model 230 SL the engine hood must be removed beforehand and the battery must be removed too. Remove the radiator upward.

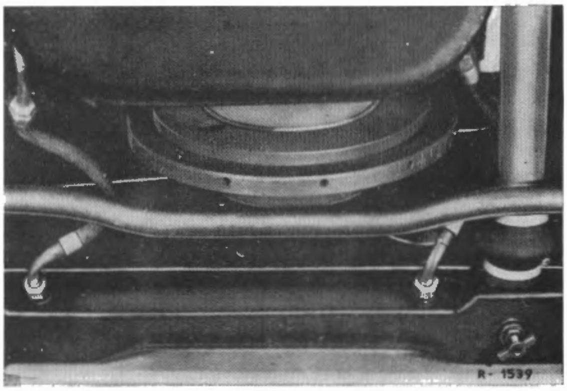


Fig. 50-1/6

Note: When repairs are carried out the 1st version of the lower cooling water line (Fig. 50-1/1) on Models 220 b, Sb, SEb should always be replaced by the 2nd version (Fig. 50-1/2). This makes for a more elastic connection between the engine and the radiator and provides for extra safety. Hardened cooling water hoses or hoses which have become spongy because of contact with oil should always be replaced. Always install hoses from our approved list.

Installation:

Note: Before installing the radiator, and this is particularly important when carrying out repairs on cars involved in an accident, always measure the inside diameter between the stiffening plates "B 1" at the bores and the width of the radiator "B 2" including the two rubber pads ("a") (Fig. 50-1/7).

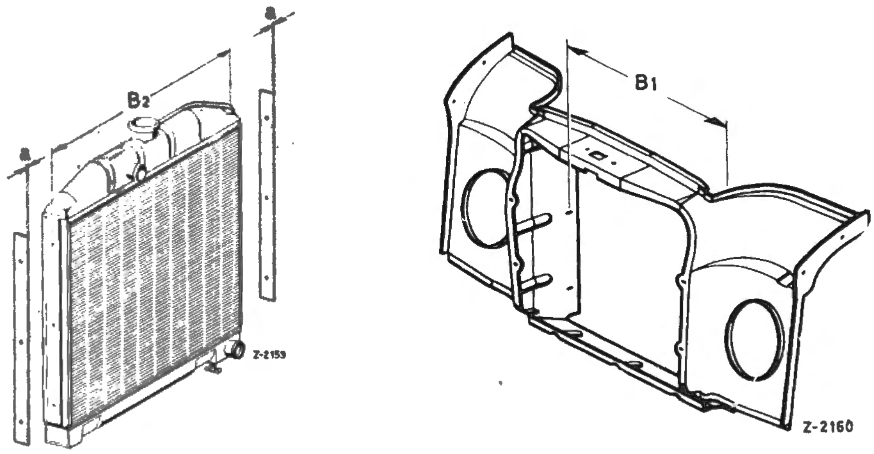
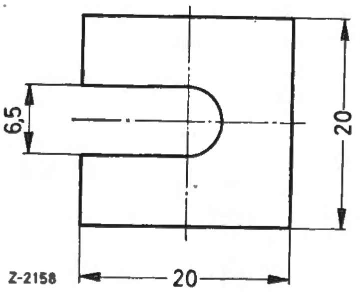


Fig. 50-1/7

If the dimension "B 1" between the stiffening plates is larger than the radiator block "B 2" including the two rubber pads "a", the radiator would be under stress when the hexagon screws are tightened. As a result the side fixing plates of the radiator may become detached at the soldering points which would lead to leaks. To prevent such leaks the difference must be compensated for by shims of the appropriate thickness. These shims can be made in the shop in accordance with the dimensions given in Fig. 50-1/8.



Thickness as required

Fig. 50-1/8

6. Install the radiator from above, at the same time inserting the cooling water hoses in the upper and lower pipe sockets. Care must be taken to ensure that the radiator ribs are not damaged by the fan.

7. Fasten the radiator to the stiffening plate, making sure that the side rubber pads and the upper and lower sealing strips are correctly positioned (Figs. 50-1/2 to 5).

   If required insert shims between the rubber pad and the stiffening plate.

8. Check the distance between the fan front edge and the radiator and if necessary adjust (Fig. 50-1/9).

9. On cars with automatic DB transmission attach the hose connections to the transmission oil cooler (Fig. 50-1/6).

Model	Fan distance "a"
190 c 190 Dc 220 b 220 Sb 220 SEb	18 + 2
230 SL 300 SE	20 + 2

Note: Absolute cleanliness is of paramount importance whenever jobs are carried out on the transmission oil cooler.

10. Attach the hose clamps for the cooling water hoses and on Model 230 SL attach the bleeder hose (5) (Fig. 50-1/4).

Caution! It is essential that the cooling water hoses should be bushed on the pipe unions of the radiator as far as they will go. The hose clamps should be attached in such a way that they are seated between the corrugation on the pipe union and the water tank.

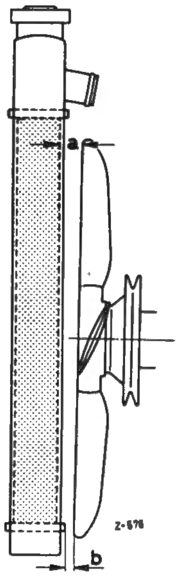


Fig. 50-1/9

11. Switch the two heater control levers on the instrument panel to position "warm".

12. Fill up **slowly** so that the air can escape.

The cooling water must be treated with additives as soon as the vehicle is put into operation for the first time. If this is not done scale and rust will form and these gradually decrease the efficiency of the cooling system.

13. Run the engine for about 1 minute at a fast idle, leaving the radiator filler neck open.

14. Reduce the idle to normal and slowly top up the cooling system as follows:

if the cooling water is **cold,** up to the marking plate which can be seen in the filler neck,

if the cooling water is **hot,** about 1 cm higher.

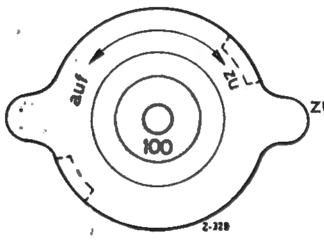
Caution: When the engine is hot, cold cooling water should only be poured into the radiator slowly and with the engine running; hot cooling water can be poured into the cold engine without any trouble.

15. Make sure to screw on the correct radiator cap.

When screwing on the radiator cap screw it on as far as the stop (notch 2).

Note: The correct radiator cap is marked 100 on the top (Fig. 50-1/10), which means that the overpressure valve opens at 1 atm. and the vacuum valve at 0.1 atm. (Fig. 50-1/11).

auf = open



zu = closed

Fig. 50-1/10

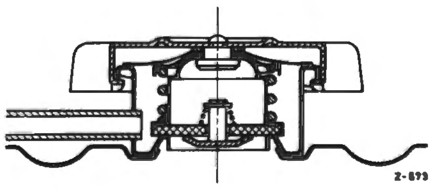


Fig. 50-1/11

16. Check the hose connections, the radiator and the transmission oil cooler for leaks (see also Job No. 50-3).

Electrical System — Groups 15/54/82

Job No.
15-0

Electrical System

Test Values, Measurements and Tolerances

Battery

Type		190 c	220 b and 220 Sb	220 SEb	190 Dc 300 SE
Battery	Voltage volts	12			
	Capacity Ah	66	56 1st version 52 2nd version	60	52
Acid level above top edge of separator or above acid level mark mm[1])		5			
Specific gravity of acid at 20° C or acid density	fully charged	1.28 (tropics 1.23)			
	semi-charged	1.21 (tropics 1.16)			
	discharged	1.14 (tropics 1.09)			
Charging current in amp.	initial charging	max. 5 %	of battery capacity		
	ordinary recharging	max. 10 %			
	quick charging	up to 75 %			
Acid temperature before charging		16—32° C			
Maximum temperature		40° C			
Maximum temperature (tropics)		50° C			
Freezing point	fully charged	—68° C (tropics —40° C)			
	semi-charged	—40° C (tropics —13° C)			
	discharged	—12° C (tropics —13° C)			

Note: The separators are approx. 10 mm higher than the plates.

[1]) The acid level should not exceed the top edge of the separator or the acid level mark by more than 5 mm even **with the battery fully charged** (acid density 1.28 or 1.23 tropics).

Removal and Installation of Starter

Job No.
15-1

Removal:

1. Disconnect the ground cable at the negative terminal of the battery.

2. Disconnect the control cable at terminal 50 of the solenoid switch, and the battery cable 30 and the cable 51 (charging cable from generator to battery) at the contact terminal (4) of the solenoid switch (3) (Fig. 15-1/1).

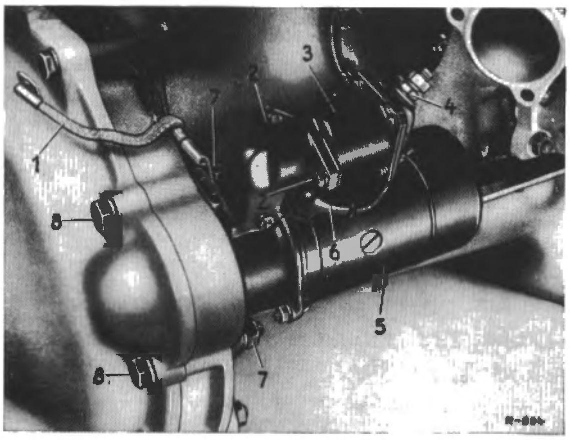


Fig. 15-1/1

1 Ground cable
2 Hexagon screws
3 Solenoid switch
4 Connecting bolt
5 Starter
6 Connecting cable
7 Hexagon nut
8 Hexagon screws

3. Screw out the nuts (7) of the starter fixing screws (8) and remove the ground cable (1) to the cowl (Fig. 15-1/1).

4. Pull out the starter from the fixing screws (8) and remove downward.

Installation:

5. During installation pay attention to the following points:

   a) Remember to attach the ground cable (1) to the cowl at the upper fixing screw.

   b) The control cable must not be passed through the rubber cover cap of the battery cable since it will rub against the contact terminal for the battery cable and may become live. As a consequence the starter may be operated when the engine is running and may damage the starter gear rim. Therefore the control cable should be wound around cables 30 and 51 and should be connected directly to terminal 50.

Job No.
15-2

Removal and Installation of Solenoid Switch

Removal:

1. Disconnect the ground lead at the negative terminal of the battery.

2. Remove the battery cable 30 and cable 51 at the contact terminal (4) of the solenoid switch (Fig. 15-2/1).
   Disconnect the control cable at terminal 50.

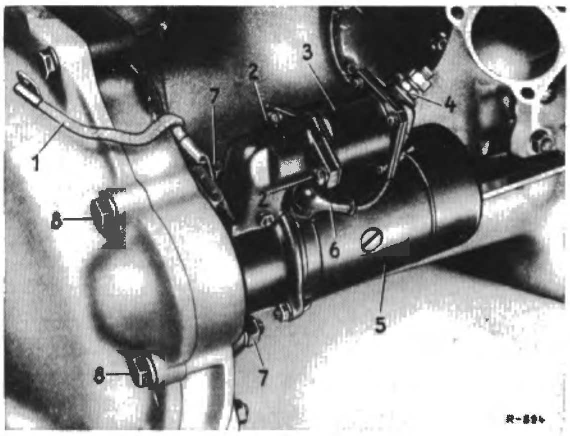


Fig. 15-2/1

1 Ground strap	5 Starter
2 Hexagon screws	6 Connecting cable
3 Solenoid switch	7 Hexagon nut
4 Connecting bolt	8 Hexagon screws

3. Loosen and remove the cable (6) from the field coil to the solenoid switch (Fig. 15-2/1).

4. Remove the two hexagon screws (2) at the drive bearing cover flange.

5. Disengage the solenoid switch from the actuating trigger and slide out the switch.

Installation:

6. Check and if necessary, correct the adjustment dimension "a" at the solenoid switch.

   When this is being done, the linkage yoke must be drawn in (for dimension and Fig. see Job No. 15-0, Section A).

   After adjustment, the linkage yoke and counternut should be locked with a dab of Enamel Fl 53 V 8.

7. The rest of the installation procedure is the reverse of the removal procedure.

Trouble-Shooting Hints for the Starter

Job No.
15-6

Cause	Remedy
Starter shaft fails to turn or turns too slowly when starter is switched on	
1. Battery discharged	1 Charge battery
2. Battery defective	2. Check battery and if necessary, repair or replace
3. Battery terminals loose, oxidised, or ground connection bad	3. Tighten terminals, clean terminals and clamps, and grease with acid-resisting grease
4. Starter terminals or brushes shorten to earth	4. Remove short
5. Carbon brushes not making proper contact with collector, sticking in their guides, worn, broken, oiled-up, or fouled	5. Examine carbon brushes, and clean or replace; if necessary, clean guides in brush holder
6. Solenoid switch of starter damaged	6. Replace solenoid switch
7. Excessive voltage drop in leads, damaged leads, loose contacts	7. Check starter leads and their contact terminals
Armature turns, but pinion fails to engage	
1. Pinion fouled	1. Clean pinion
2. Mesh damage to pinion or ring gear, burrs	2. Remove burrs
When starter is switched on, armature turns until pinion is engaged, but then stops	
1. Battery insufficiently charged	1. Charge battery
2. Carbon brush pressure inadequate	2. Examine carbon brushes, and clean or replace
3. Solenoid switch of starter out of order	3. Replace solenoid switch
4. Excessive voltage drop in leads	4. Check leads and contact terminals
Starter continues to turn after the starter switch has been released	
Starter push-button switch fails to switch off, or solenoid switch is sticking	Immediately disconnect starter lead at battery or at starter. Repair or replace starter push-button switch or solenoid switch
Pinion does not engage, and starter spins freely at high speed	
Pinion or flywheel ring gear either very dirty or damaged; compression spring in solenoid switch weak or broken	Carefully clean pinion and ring gear or remove burrs on ring gear and on pinion (push vehicle backward and forward with gears engaged); replace compression spring in solenoid switch
Pinion engages, and starter begins to slip and rage	
Overrunning clutch slipping	Replace pinion and overrunning clutch as an assembly

Job No.
15-11

Removal and Installation of Generator

Removal:

1. Disconnect the ground cable at the negative terminal of the battery.

2. Disconnect the electric cables from the generator.

3. Loosen the two nuts (2) on the hexagon screws (1) of the generator mounting (Fig. 15-11/1).

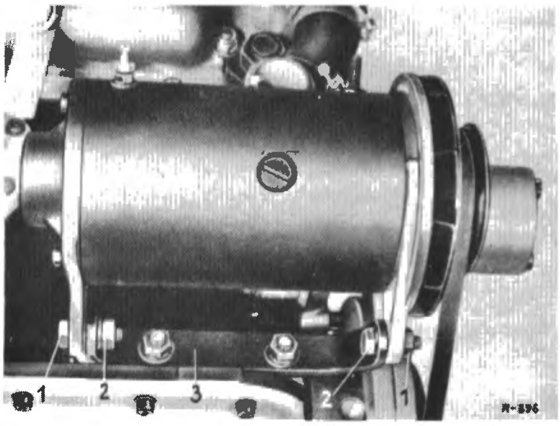


Fig. 15-11/1

1 Hexagon screw
2 Hexagon nut
3 Generator

4. Unscrew the nuts (1) and (2) from the tensioning screw (4) as far as it is necessary to be able to remove the Vee-belt (6) (Fig. 15-11/2).

5. Unscrew the nuts from the hexagon screws (1) on the generator support (3) (Fig. 15-11/1) and the fixing screw with clamping wedge from the tensioning screw (4) (Fig. 15-11/2) and remove the generator.

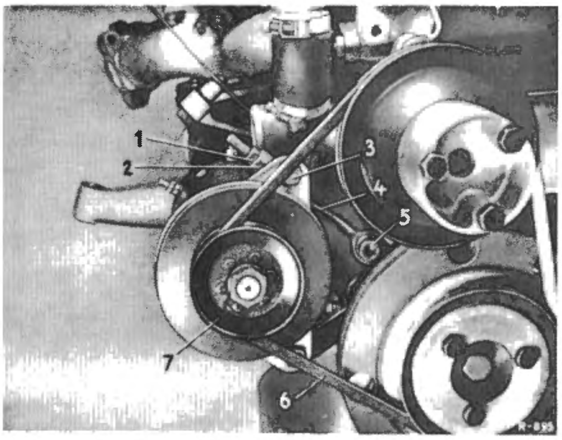


Fig. 15-11/2

1 Lock nut
2 Clamp nut
3 Hexagon screw
4 Tensioning screw
5 Socket screw
6 Narrow Vee-belt
7 Vee-pulley

Installation:

6. During installation pay attention to the following points:

   a) Before putting on the Vee-belt check the alignment of the pulleys.

   b) The Vee-belt must be tensioned to such an extent that it can be pressed out of the straight by 5 mm to a maximum of 10 mm when moderate thumb pressure is applied.

   c) When connecting the electric cables pay attention to the color coding. Connect: The black cable to terminal DF, the red cable to terminal D +, the brown cable to terminal D —.
   If the cables are not connected correctly there may be pole reversal of the generator and consequently destruction of the regulator.

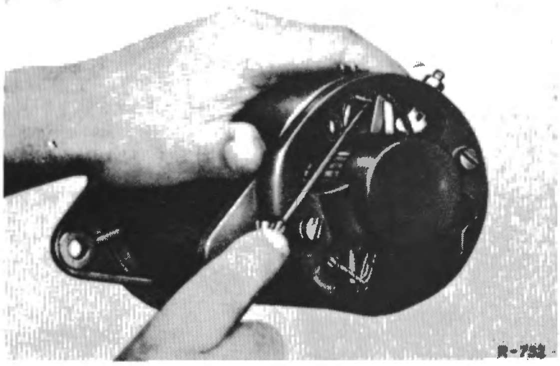
Servicing Hints for Generator, with Generator removed from Vehicle

Job No. 15-12

The generator must be removed from the vehicle for servicing

Carbon Brushes

The carbon brushes must be examined after 50,000 km unless the conditions in which the vehicle is operating (dust, dirt, etc.) require that the examination be carried out more frequently. The generator LJ/GG 240/12-2400 R 8 has a new brush holder design; the brush holders have been offset from the center and are no longer fastened to the collector bearing but to the armature housing. Insert a suitable screw driver under the carbon brush below the connecting wire and carefully push the brush upward until it engages in the gap between the brush holder and the armature housing. In this position the brush spring presses the carbon brush into an oblique position.



Checking the carbon brushes

Fig. 15-12/1

The brush and the brush holder must be free from dust, oil, and grease. If these parts are fouled or sticking and the brush does not make contact with sufficient pressure on the collector, they must be cleaned with a clean gasoline-soaked rag (not with cotton waste) and well dried. Never use emery paper, a knife or a file on the contact surface of the brush! Thoroughly blow out the brush holder with compressed air.
If a brush is broken, has come unsoldered or is worn to the point where either the spring or the stranded wire soldered into the brush is in danger of fouling the brush holder, it must be replaced. When inserting the brush, care must be taken to ensure that the spring does not strike hard against the brush. Always replace all brushes and only use the specified type for replacement!

Collector

The condition of the surface of the collector is extremely important for the proper functioning of the generator. The surface of the collector should be uniformly smooth and grey-black in color; it must also be free from dust, oil, and grease. The collector must also run perfectly true and without radial deflection, since otherwise the carbon brushes will bounce in consequence of the high spots and will arc. Fouled collectors should be cleaned with a clean gasoline-soaked rag (not with cotton waste) and well dried. Scored and out-of-round collectors must be conditioned by precision-turning (see Job No. 15-13). Under no circumstances must emery paper or a file be used on the collector.

Lubrication

The generator is fitted with ball bearings (annular grooved bearings) which are provided with a grease reserve sufficient for their service life. No further lubrication is therefore necessary.

Job No. 15-14 Removal and Installation of Regulator Switch (Three-Element Voltage/Current Regulator)

Removal:

1. Disconnect the ground cable at the negative terminal of the battery.

2. Disconnect the electric cables from the regulator (3), which is on the right wheel-arch, and unscrew the regulator from the bracket (2) (Fig. 15-14/1).

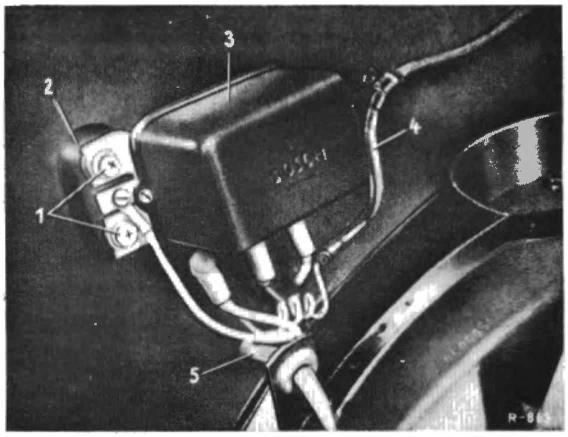


Fig. 15-14/1

1 Cross-recess head screws
2 Bracket
3 Voltage/current regulator
4 Cable sheaf from main wiring harness
5 Wiring harness from generator to regulator switch

Note: If any malfunction or defect is noticeable in the regulator it must always be replaced; no repairs to the regulator must be undertaken. Particular care must be taken to ensure that the regulator does not suffer any violent shocks.

Installation:

3. When connecting the electric cables, pay attention to the color coding:

   From the wiring harness from the generator to the regulator, connect:

   the brown cable to the terminal D —,
   the black cable to the terminal DF,
   the red cable to the terminal D + (61).

   From the main wiring harness, connect:

   the blue cable to the terminal D + (61),
   the red cable to the terminal B + (51).

Note: Be sure to connect cables to correct terminals. Incorrect connection of the terminals involves pole-reversal of the generator and results in the destruction of the regulator.

Trouble Shooting Hints for the Generator

Job No.
15-17

When trouble occurs in the current supply system, it should always be borne in mind that the fault may lie not only in the generator or the regulator but in the battery, the leads, or at other points in the system.

Battery not charging or not charging sufficiently

Cause	Remedy
1. Carbon brushes not making proper contact with collector, sticking in the guides, worn, broken, oiled-up or fouled.	1. Examine carbon brushes and clean or replace, as necessary.
2. Collector fouled or oiled-up.	2. Clean collector.
3. Collector worn.	3. Re-condition collector by precision-turning and making saw-cuts between segments.
4. Faulty connections or other damage at the following points: cable 30 (battery cable) and cable 51 between battery and regulator, or cable 31 between battery and ground.	4. Tighten connections or replace cables.
5. Battery defective.	5. Check battery and if necessary, replace.
6. Break or short-circuit in windings of generator or short-circuit to ground.	6. Check generator and if necessary, repair.
7. Regulator defective.	7. Replace regulator.
8. Fan belt too slack. V–pulleys worn.	8. Tighten fan belt to specified tension. Replace V-pulleys.

Charging light does not light up with engine stopped and ignition switched on

Cause	Remedy
1. Charging light bulb burnt out.	1. Fit new bulb.
2. Battery discharged.	2. Charge battery from outside source.
3. Battery defective.	3. Check battery and if necessary, replace.
4. Cables of terminals 61, 30 or 31 loose or damaged.	4. Bare, clean or replace cables; tighten contacts.
5. Regulator defective.	5. Replace regulator.

Charging light fails to extinguish at high engine speed	
Cause	**Remedy**
1. Cable of terminal 61 shorting to ground.	1. Remove short or replace cable.
2. Regulator defective.	2. Replace regulator.

Charging light flickers	
Cause	**Remedy**
1. Fan belt too slack.	1. Tighten fan belt to specified tension.
2. V-pulleys worn.	2. Replace V-pulleys.

Color Code and Function of Electric Leads

Job No.
54-1

Modification: Models 190 c, 190 Dc and 300 SE added, Job No. revised.

In the following tables the color code and function of all electric leads in the car are listed.

Basic color	Color coding	Function of Leads	Remarks
		Leads Direct to Fuse Box	
red	—	from rotary light switch terminal 30 to fuse box terminal 30	all models
red	black	from ignition lock terminal 15/54 to fuse box terminal 15/54	all models
white	—	from foot dimmer switch terminal 56a to fuse box terminal 56a	all models
yellow	—	from foot dimmer switch terminal 56b to fuse box terminal 56b	all models
grey	—	from rotary light switch terminal 58 to fuse box terminal 58	all models
		Leads behind the Fuse Box (Fuse-Protected) to Consumer Units	
red	with color coding	all leads of terminal 30 (cannot be switched off by means of the ignition lock)	all models
black	with color coding	all leads of terminal 54 (can be switched off by means of the ignition lock)	all models
white	with and without color coding	To upper beam left and right and upper beam pilot light	all models
yellow	with and without color coding	To lower beam left and right	all models
grey	with color coding	all leads of terminal 58	all models
		Leads of Glow Plug System of the Diesel Engine	
violet	with color coding	all leads of glow plug system of Diesel engine	190 Dc
		Leads Direct for Current Generation and Supply	
black	—	starter lead from battery + to starter terminal 30	all models
black	—	starter lead from battery + to battery main switch	S. A.
black	—	from starter terminal 30 to ammeter	S. A.
red	—	from ammeter to regulator (Lima) terminal B + 51	S. A.
red	—	from starter terminal 30 to rotary light switch terminal 30	all models
red	—	from starter terminal 30 to regulator (Lima) terminal B+51	all models
red	—	from ammeter to rotary light switch terminal 30	S. A.
red	—	from rotary light switch terminal 30 to ignition lock terminal 30	all models
red	—	from rotary light switch terminal 30 to fuse box terminal 30	all models
blue	—	from regulator (Lima) terminal 61 to charging light	all models
		Ground Leads and Connections	
black	—	from negative battery pole to ground	all models
black	—	from negative battery pole to battery main switch	S. A.
black	—	from battery main switch to ground	S. A.
bright	—	ground leads from engine to chassis or corresponding ground connections of more than 4 mm²	all models
brown	—	ground leads direct to chassis within wiring harnesses	all models
		Consumer Units of Terminal 30 (Cannot be switched off by means of the Ignition Lock)	
red	—	from rotary light switch terminal 30 to fuse box	all models
red	white	from fuse box to socket	all models
red	yellow	from fuse box to electric clock	all models
red	green	from fuse box to reading light	all models
red	violet/ green	from fuse box to roof light	220 Sb, SEb 300 SE

Basic color	Color coding	Function of Leads	Remark
red	blue	from fuse box to radio	S. A.
red	green	from fuse box to rotary light switch terminal clearance light	all models
red	green/ black	from rotary light switch terminal clearance light to clearance light switch	all models
green	black	from clearance light switch to clearance light left front and left rear	all models
green	—	from clearance light switch to clearance light right front and right rear	all models
black	pink/ white	from fuse box to starter valve magnet	220 SEb, 300 SE
red	white/ green	from fuse box to glove compartment lighting	220 SEb, 300 SE
		Ignition Switch and Ignition, Starter, High and Low Tension Leads	
red	—	from rotary light switch terminal 30 to ignition lock terminal 30	all models
red	black	from ignition lock terminal 15/54 to fuse box terminal 54	all models
red	black	from ignition lock terminal 15/54 to ignition coil terminal 15	all models
red	black	from ignition lock terminal 15/58 to series resistance for ignition coil terminal 15	220b, Sb, SEb and 300 SE
black	—	from series resistance for ignition coil terminal 16 to ignition coil terminal 16	220 b, Sb, SEb and 300 SE
black	—	from ignition coil terminal 1 to distributor terminal 1	190 c, 220b, Sb, SEb and 300 SE
black	—	from ignition coil terminal 4 to distributor terminal 4	190 c, 220b, Sb, SEb and 300 SE
black	—	from distributor to the spark plugs	190 c, 220b, Sb, SEb and 300 SE
violet	—	from ignition lock terminal 50 to starter terminal 50	190 c, 220b, Sb, SEb and 300 SE
		Foot Dimmer Switch and Headlights	
white	yellow	from rotary light switch terminal 56 to foot dimmer switch terminal 56	all models
white	—	from foot dimmer switch terminal 56b to fuse box terminal 56b	all models
white	—	from fuse box terminal 56a to upper beam right	all models
white	black	from fuse box terminal 56a to upper beam left	all models
white	blue	from fuse box terminal 56a to upper beam pilot light	all models
yellow	—	from fuse box terminal 56b to lower beam right	all models
yellow	black	from fuse box terminal 56b to lower beam left	all models
		Leads of Terminal 58	
grey	—	from rotary light switch terminal 58 to fuse box terminal 58	all models
grey	red	from fuse box terminal 58 to parking light right, tail light right, license plate light right	all models
grey	black	from fuse box terminal 58 to parking light left, tail light left, license plate light left	all models
grey	violet	from fuse box terminal 58 to instrument lighting switch	all models

Basic color	Color coding	Function of Leads	Remarks
grey	blue	from instrument lighting switch to instrument lights	all models
grey	green/yellow	from fuse box terminal 58 to fog light switch	all models
grey	green	from fog light switch to fog lights left and right	all models
grey	blue	from instrument cluster switch to electric clock lighting	all models
grey	blue	from instrument cluster to speed indicator light	S. A. and 300 SE
		Leads of Terminals 15/54 Flash Signal System	
black	red/green	from fuse box terminal 54 to flash signal mechanism terminal 15	all models
black	white/green	from flash signal mechanism terminal 54 to flash signal switch terminal 54	all models
black	white	from flash signal switch terminal 54 left to flash signals front left and rear left	all models
black	green	from flash signal switch terminal 54 right to flash signals front right and rear right	all models
green	blue	from flash signal mechanism K to pilot light (only used if pilot light installed)	all models
black	white	from flash signal switch to pilot light left	all models
black	green	from flash signal switch to pilot light right	all models
		Upper Beam Flash Signal System (Flash approach signal)	
white	violet	from upper beam flash signal switch to fuse box terminal 56 a	all models
black	blue/white	from upper flash signal switch to fuse box terminal 15/54	all models
		Stop Light	
black	red/violet	from fuse box terminal 54 to stop light switch	all models
black	red	from stop light switch to stop lights left and right	all models
		Cigar Lighter	
black	yellow/green	from fuse box terminal 54 to cigar lighter	all models
		Reversing Lights	
black	yellow/red	from fuse box to reversing light switch	all models
grey	yellow	from reversing light switch to reversing lights left and right	all models
		Hand Brake Control	
black	brown/white	from fuse box terminal 15/54 to hand brake pilot light switch	all models
brown	white/red	from hand brake pilot light switch to instrument cluster pilot light	all models
		Compressed-Air Control	
black	brown/white	from fuse box terminal 15/54 to compressed-air control switch	300 SE
brown	white/red	from compressed-air control switch to instrument cluster pilot light	300 SE
		Valve Block Control (Wheel Changing)	
black	brown/white	from fuse box terminal 15/54 to valve block control switch	300 SE
brown	white/red	from valve block control switch to instrument cluster pilot light	300 SE
		Signal System	
black	yellow	from fuse box terminal 15/54 to horns I, II and III	all models
black	yellow/pink	from signal ring terminal horn contact to horns I, II and III	all models

Basic color	Color coding	Function of Leads	Remarks
		Signal System with Relays	
black	yellow/white	from fuse box terminal 15/54 to horn relay terminal 30/51	S. A.
black	yellow/white	from horn relay terminal 30/51 to terminal 86	S. A.
black	yellow	from horn relay terminal 87 to horns I, II and III	S. A.
black	yellow/violet	from horn relay terminal 87 via pull switch to horn II or III	S. A.
		Windshield Wiper System	
black	violet	from fuse box terminal 15/54 to wiper switch terminal +	all models
black	violet	from fuse box terminal 15/54 to wiper motor terminal +	all models
black	violet/blue	from wiper switch terminal 1 to wiper motor terminal 1	all models
black	violet/white	from wiper switch terminal 2 to wiper motor terminal 2	220 b, Sb, SEb 300 SE
black	violet/green	from wiper switch terminal 3 to wiper motor terminal 3	220 b, Sb, SEb 300 SE
		Windshield Washer System	
black	violet	from fuse box terminal 15/54 to foot pump terminal +	220 b, Sb, SEb 300 SE
black	blue/yellow	from foot pump terminal 1 to wiper switch terminal 1	220 b, Sb, SEb 300 SE
black	violet/pink	from foot pump terminal 2 to wiper switch terminal 2	220 b, Sb, SEb 300 SE
black	violet/white	from foot pump terminal 2 to wiper motor terminal 2	220 b, Sb, SEb 300 SE
		Fuel Gage	
black	blue	from fuse box terminal 15/54 to fuel gage terminal +	all models
blue	black	from fuel gage to fuel level indicator mechanism	all models
blue	green	from fuel gage to fuel level indicator mechanism terminal fuel reserve indicator	all models
		Choke Control	
black	red/blue	from fuse box terminal 15/54 to choke control switch	190 c, 220 b, Sb
pink	blue	from choke control switch to pilot light on instrument cluster	190 c, 220 b, Sb
		Defroster Blower (Heater Blower)	
black	green/pink	from fuse box terminal 15/54 to heater blower switch terminal +	all models
green	red	from heater blower switch 1st stage to heater blower motor 1st stage	all models
green	yellow	from heater blower switch 2nd stage to heater blower motor 2nd stage	220 b, Sb, SEb 300 SE
		Defroster Blower (Rear Compartment Heater Blower)	
black	green/pink	from fuse box terminal 15/54 to rear compartment heater blower switch terminal +	300 SE
black	green/pink	from fuse box terminal 15/54 to rear compartment heater blower motor standard stage	300 SE
green	red	from rear compartment heater blower switch 1st stage to rear compartment heater blower motor 1st sage	300 SE
green	yellow	from rear compartment heater blower switch 2nd stage to rear compartment heater blower motor 2nd stage	300 SE

Basic color	Color coding	Function of Leads	Remarks
		Electric Fuel Feed Pump	
black	white/red	from fuse box terminal 15/54 to electric fuel feed pump terminal +	220 SEb, 300 SE
		Automatic Auxiliary Start Mechanism (Mixture Control Knob)	
black	pink/red	from fuse box terminal 15/54 to automatic auxiliary start mechanism relay terminal 30/51	220 SEb, 300 SE
black	pink	from automatic auxiliary start mechanism relay terminal 87 to magnet for mixture control knob	220 SEb, 300 SE
black	pink/blue	from automatic auxiliary start mechanism relay terminal 86 to starter switch terminal 50	220 SEb, 300 SE
pink	—	from automatic auxiliary start mechanism relay terminal 85 to thermo switch	220 SEb,
		Automatic Auxiliary Start Mechanism (Electro-Magnetic Starter Valve)	
black	pink/red	from fuse box terminal 15/54 to electro-magnetic starter valve relay terminal 30/51	220 SEb, 300 SE
pink	blue	from electro-magnetic starter valve relay terminal 86 to thermo time switch terminal G	220 SEb, 300 SE
pink	white	from electro-magnetic starter valve relay terminal 85 to thermo time switch terminal W	220 SEb, 300 SE
black	pink/white	from electro-magnetic starter valve relay terminal 87 to magnet electro-magnetic starter valve	220 SEb, 300 SE
		Automatic Auxiliary Start Mechanism (Time Relay)	
pink	yellow	from automatic auxiliary start mechanism relay terminal 85 to time relay terminal 85	220 SEb, 300 SE
pink	yellow/black	from automatic auxiliary start mechanism relay terminal 86 to time relay terminal 86	220 SEb, 300 SE
		Leads of Glow Plug System on Diesel Engine	
red	black	from ignition lock terminal 15/54 to glow plug starter switch terminal 15/54	190 Dc
violet	blue	from glow plug starter switch terminal 19 to glow plug indicator resistor terminal 19	190 Dc
violet	white	from glow plug indicator resistor terminal 17 to glow plug series resistance terminal 17	190 Dc
violet	white	from glow plug starter switch terminal 17 to glow plug indicator resistor terminal 17	190 Dc
black	—	from glow plug series resistance to glow plug	190 Dc
violet	—	from glow plug starter switch terminal 50 a to starter terminal 50	190 Dc
bright	—	connecting leads of glow plugs	190 Dc
		Automatic DB Transmission	
black	red	from fuse box terminal 15/54 to double lift magnet	S. A. and 300 SE
brown	black	from kickdown switch to double lift magnet	S. A. and 300 SE
brown	white	from idle switch (accelerator pedal) to double lift magnet	S. A. and 300 SE
black	green/red	from fuse box terminal 15/54 to idle increase magnet terminal +	S. A. and 300 SE
green	red	from oil pressure switch on automatic transmission to idle increase magnet terminal 31	S. A. and 300 SE

Basic color	Color coding	Function of Leads	Remarks
		Automatic Clutch	
brown	black/ yellow	from fuse box terminal 15/54 to electro-magnetic pilot valve	S. A.
brown	white	from automatic clutch relay terminal 85 to servo motor switch	S. A.
brown	black/ yellow	from fuse box terminal 15/54 to automatic clutch relay terminal 86	S. A.
brown	red	from automatic clutch relay terminal 87 to solenoid for reducing valve terminal 54	S. A.
brown	black/ yellow	from electro-magnetic pilot valve terminal 54 to solenoid for reducing valve terminal 54	S. A.
black	—	from shift lever contact to electro-magnetic pilot valve terminal 31	S. A.
brown	white	from rear axle switch to servo motor	S. A.
brown	yellow	from thermo switch pilot light to pilot light switch (1st gear)	S. A.
brown	yellow	from pilot light switch (1st gear) to pilot light for automatic clutch	S. A.

Job No.
54-11

Removal and Installation of Instrument Cluster

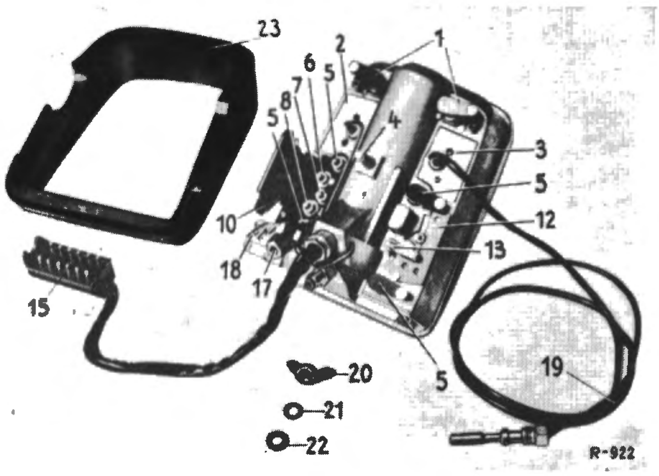


Fig. 54-11/1

1 Pilot light, flash signal
2 Oil pressure gage
3 Radiator thermometer (water)
4 Fixing bolt
5 Instrument lighting
6 Charging light
7 Pilot light, choke control
8 Pilot light, upper beam
10 Contact cover
12 Fuel gage
13 Warning light, fuel gage
15 12-pin plug
16 Speedometer connection
17 Oil pressure gage line connection
18 Adjustable dimmer resistance
19 Capillary tube with heat feeler
20 Wing nut
21 Lock washer
22 Washer
23 Instrument cluster frame

Removal:

1. Remove the left and right cover under the instrument panel.

2. Pull out the 12-pin plug (15) from below the instrument panel (Fig. 54-11/2).

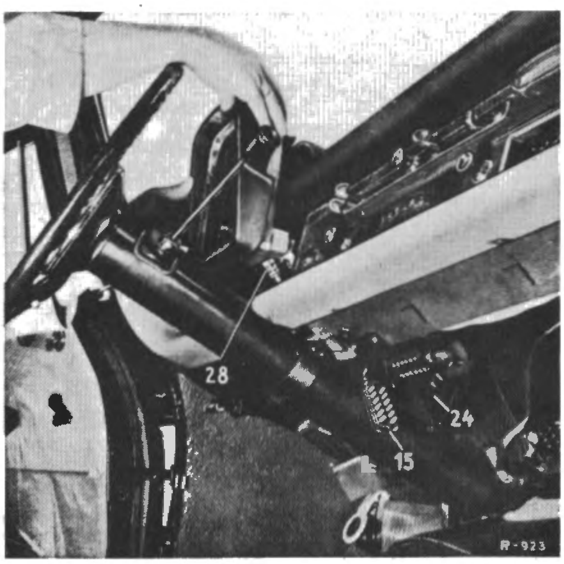


Fig. 54-11/2

15 12-pin plug for instrument cluster
24 6-pin plug for steering wiring harness
28 Speedometer drive

3. From behind the instrument panel, unscrew by hand the oil pressure gage line and the fastening nut (20) (wing nut) from the instrument cluster (Fig. 54-11/1).

4. Unscrew the capillary tube (19) for the radiator thermometer from the left side of the engine. Remove the rubber grommet for the capillary tube and the choke control, and pull the capillary tube toward the rear through the front wall.

5. Pull out the instrument cluster together with the frame toward the rear far enough to allow the speedometer drive shaft (28) to be disconnected (Fig. 54-11/2).

6. Remove the instrument cluster and frame (23) carefully, taking care not to damage the capillary tube (19) of the radiator thermometer (Fig. 54-11/1).

Installation:

7. Installation is the reverse of the removal procedure.

Instrument Cluster

Models 250 S, 250 SE, 300 SEB, 300 SEL

Job No.
54-11 a

A. Removal and Installation of Instrument Cluster

Removal:

1. Disconnect the ground cable from the battery.

2. Disconnect the capillary tube (1) for the radiator thermometer from the engine housing (Fig. 54-11 a/1).

Note: Close the threaded hole in the engine housing with a plug to prevent the cooling water from escaping.

3. Remove the left cover below the instrument panel.

4. Pull out the 13-pin plug (2) for the instrument cluster.

5. Unscrew the holder for the plug couplings.

6. Unscrew the fixing nut (5) for the instrument cluster.

Note: To prevent damage to the garnish molding on the instrument panel and to the steering column jacket cover these parts with a cloth.

7. Carefully pull out the instrument cluster (23) and disconnect the speedometer drive shaft and the oil pressure line (Fig. 54-11 a/2).

8. Remove the instrument cluster (23) completely.

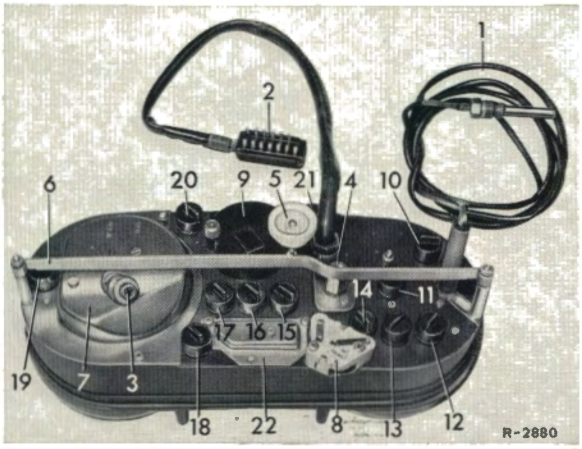


Fig. 54-11 a/1

1 Capillary tube with heat feeler
2 13-pin plug
3 Speedometer connection
4 Oil pressure gage connection
5 Fixing nut
6 Retainer
7 Speedometer
8 Adjustable lighting resistance
9 Clock
10 Instrument cluster lighting
11 Warning light, fuel gage
12 Warning light, hand brake
13 Level pilot light only on 300 SEL air suspension models
14 Charging light
15 Pilot light, flash signal
16 Pilot light, upper beam
17 Pilot light, righ flash signal
18 Speedometer lighting
19 Speedometer lighting
20 Speedometer and clock lighting
21 Clock and instrument cluster lighting
22 Cover of gear indicator (automatic transmission)

Installation:

9. Installation is the reverse of the removal procedure.

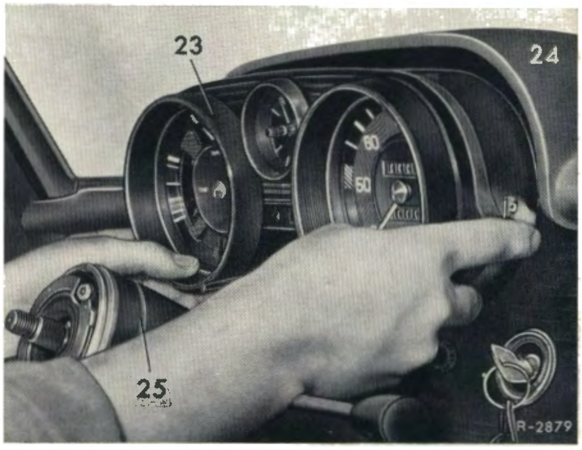


Fig. 54-11 a/2

23 Instrument cluster
24 Upper padding
25 Steering column jacket

B. Replacement of Bulbs in the Instrument Cluster

1. Remove left cover below the instrument panel.

2. Unscrew the holder for the plug couplings (Fig. 54-11 a/1).

3. Carefully pull out the instrument cluster (23) until the sockets (10-21) of the bulbs become accessible (Figs. 54-11 a/1 and 2).

Note: To prevent damage to the garnish molding on the instrument panel and to the steering column jacket cover these parts with a cloth.

5. Remove the damaged bulb together with its socket and replace the bulb (Fig. 54-11 a/3).

6. Installation of the instrument cluster is the reverse of the removal procedure.

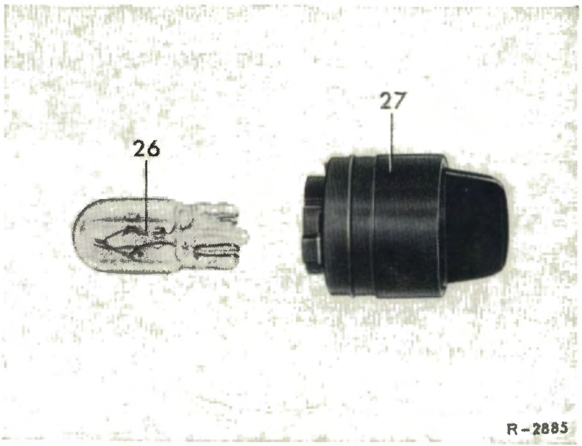


Fig. 54-11 a/3

26 Exchangeable bulb
27 Socket

Removal and Installation of Electric Clock

Job No.
54-12

Modification: Model 230 SL added

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE

Removal:

1. Remove the right inside cover from the cowl.

2. From behind the instrument panel compress the two tensioning springs (2) of the electric clock mounting and remove the clock (1) toward the front (Fig. 54-12/1).

Note: When pushing out the clock care must be taken to ensure that the wood panel of the instrument panel is not damaged.

3. Pull the plug (3) out of the clock (Fig. 54-12/1).

Installation:

Installation is the reverse of the removal procedure.

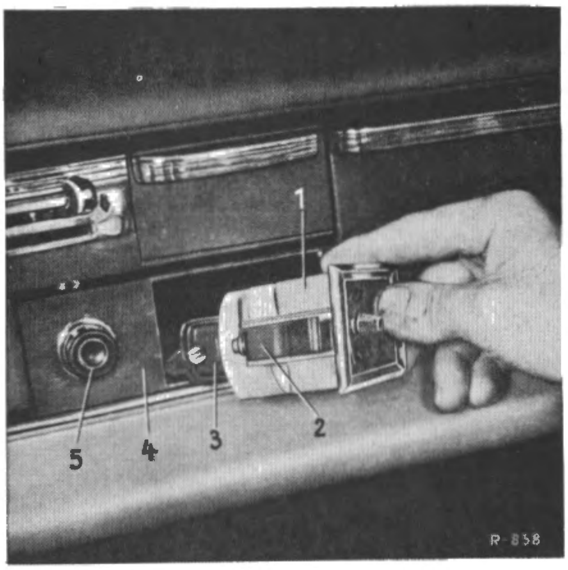


Fig. 54-12/1

1 Clock
2 Tensioning spring
3 Plug connection
4 Wood panel
5 Cigar lighter

Model 230 SL

Removal:

1. Remove the glove compartment (see Job No. 68-1).

2. Unscrew the two knurled nuts (2) for the attachment of the clock (1); detach the cable (3) from the retainer (4) since the cable would be in the way during this operation (Fig. 54-12/2).

3. Pull out the plug (5), remove the bracket (6), and pull the clock out of the instrument panel.

Installation:

4. Installation is the reverse of the removal procedure.

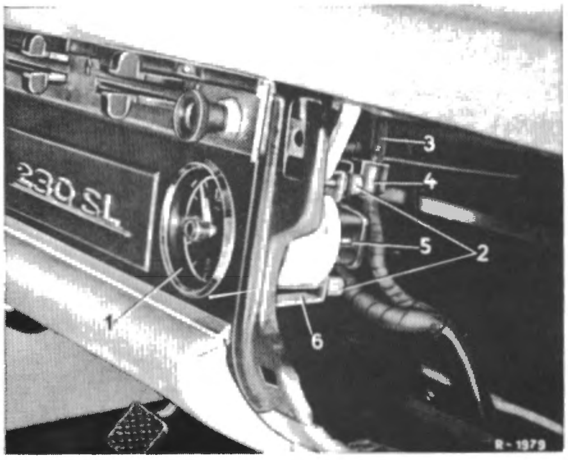


Fig. 54-12/2

1 Clock
2 Knurled nut
3 Cable
4 Cable retainer
5 Plug
6 Bracket

Job No.
54-13

Battery

A. General Remarks on the Battery

The battery must be regularly serviced and must always be kept clean and dry. No dirt must be allowed to penetrate into the cells; gasoline, benzol or oil must not be allowed to come into contact with the sealing compound. The vent holes in the battery plugs must be kept free of obstructions so that the gases given off during charging can escape freely.

Caution! The oxyhydrogen gas given off is explosive. No tools or other metal objects must be placed on the battery because of the danger of shortcircuiting! (Fig. 54-13/1).

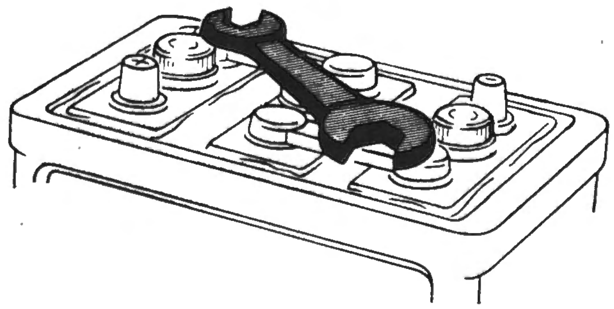


Fig. 54-13/1

Do not place metal parts on the battery

Distilled water must always be used for topping up the cells. The cells must never be topped up with sulphuric acid, irrespective of the density, unlees it is clear beyond doubt that acid has been spilt out. In the latter case, the density of the acid remaining in the cells must be measured and acid of the same density used for topping up. New batteries should be filled – according to the instructions of the makers – with chemically pure accumulator acid.

Under no circumstances should special electrolytes be used, since this would reduce the service life of the battery and would invalidate the guarantee of the battery manufacturers!

Be careful when handling sulphuric acid! It attacks and destroys lacquer finishes, metal parts and fabrics.

When mixing accumulator acid, the greatest care must be taken to ensure that the concentrated sulphuric acid is always added to the water or to the already-mixed accumulator acid and never vice versa!

Acid which has been spilt or has overflowed can be rendered innocuous by means of a soda solution or ammonium chloride.

The connections and the terminal connecting bars of the battery must be kept perfectly clean. In order to prevent corrosion, the terminals and connection clamps must be greased both **inside** and **outside** with a good acid-resisting grease, e. g. Bosch Ft 1 V [illegible]U.

The capacity of a battery is the amount of electricity measured in Ah (= current × time) which is delivered by the battery under discharge. In accordance with the German DIN standards and the SAE standards the rated capacity of a battery is given at an acid temperature of +20° to +27° C at the beginning of discharge and for a continuous discharge over a period of 20 hours and at a steady rate of current delivery. During discharge the voltage of a cell should not fall below 1.75 volts.

B. Checking Battery Acid Level and Acid Density

1. Check the acid level and the acid density.

   The battery should be topped up with pure distilled water. When the battery has been topped up with distilled water the acid density cannot be measured. The acid density can only be measured after the battery has been in operation for a short time.

   A clean glass vessel and a glass funnel should always be used for topping up with distilled water. For acid level above the top-edge of the plates see Job No. 15-0. Small amounts of distilled water can also be added by means of a hydrometer (Fig. 54-13/2).

Fig. 54-13/2

Note: The work should never be carried out near a naked light owing to the danger of explosion due to the battery releasing oxyhydrogen gas.

2. Check the state of charge of the battery by measuring the acid density. Acid should be sucked out of the battery for this purpose by means of the hydrometer (areometer). The specific gravity of the battery acid can be read off on the scale marked on the float which is suspended in the acid. A fully-charged battery should give a specific gravity reading of 1.285 = 32° Bé at an acid temperature from +20° to +27° C (Fig. 54-13/3).

Fig. 54-13/3

The specific gravity of the battery acid in relation to the state of charge of the battery is shown in Job No. 15-0.

C. Testing of Battery on Load

The individual cells of the battery are tested with the aid of a suitable cell tester. These testers are fitted with a fixed resistance or sometimes with an adjustable resistance so that the cells can be tested individually at a high amperage (mostly 200 Ampères). For an accurate test, the load should be suited to the size of the battery and adjusted with the aid of a variable resistance. But in workshop practice it is sufficient to use an available cell tester with a fixed resistance. The voltmeter which is incorporated in the cell tester can be used to read off the voltage drop of the individual cells under load. In the case of a fully-charged battery which is in good condition the voltage must not drop below 1.8 Volts within a period of 10 seconds. For the rest, the operating instructions given by the manufacturers of the tester should be adhered to.

In general, the test should be carried out in the following way:

1. Press the contact prods of the cell tester firmly on the two terminals of a cell (Fig. 54-13/4).

2. After a period of at most 10 seconds under load, read off the voltage on the voltmeter.

Note: If the battery is fully charged and is in good condition, the voltage must not drop below 1.8 Volts.

3. Check all the cells in this way.

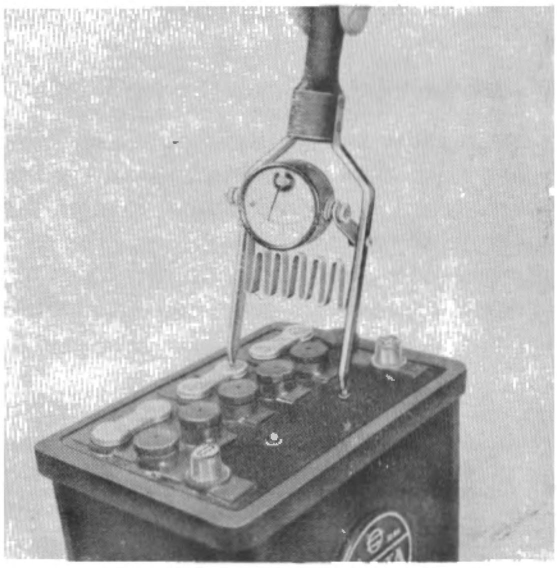


Fig. 54-13/4

A more accurate test can be made by determining the starting current load capacity of the battery by subjecting it to a high discharge test with 3 times the current intensity of the rated battery capacity. During this test the cell voltage after 30 seconds should not drop below 1.6 Volts, and if the current intensity is 5 times the rated battery capacity the cell voltage should not drop below 1.4 Volts.

Note: This high discharge test should be carried out with a tester with which the current intensity can be kept constant and on which both amperage and voltage can be read off at the same time.

D. Normal Re–Charging of Battery

It is absolutely necessary to re-charge a battery if the acid density has fallen below 1.12 = 16° Bé (in the tropics, 1.08 = 12° Bé) or if the voltage of the individual cells has fallen to 1.8 Volts.

1. Unscrew the filler caps of the individual cells.

2. Check the acid level. **If the acid level is not above the plates add only sufficient distilled water to completely cover the plates before charging the battery!**

Note: Depending on the make of the battery the separators project 5–10 mm above the upper edge of the plates.

3. Connect the battery to a charger. The positive cable of the charger is connected to the positive terminal of the battery and the ground cable of the charger to the negative terminal of the battery.

4. Charge the battery with 1/10 of the rated capacity.

Note:

a) While the battery is being charged, the acid temperature must not rise above **40° C (in the tropics, 45° C).** If the acid temperature is higher, the rate of charging must be decreased and the period of charging increased.

b) If the battery plates are sulfated (which can easily be seen from the white deposit on the positive and negative plates) the battery cannot be charged in the normal way. Since the counter e. m. f. has changed, the degree of sulfation determines the charging current permissible under the circumstances. Such batteries should always be charged at a much lower current intensity, appr. 1 % of the rated capacity of the battery. The current intensity can only be increased when the counter e. m. f. has dropped.

c) The charging process can be considered to be finished when the cell voltage and the acid density no longer increase during a period of 1 hour. If the battery is fully charged the cell voltage should be 2.6 to 2.7 Volts.
The voltage must be measured with the charger switched on. When the charger is switched off the cell voltage drops to 2.2 Volts within 2 hours.
The acid density in a fully-charged battery should be 1.285 = 32° Bé (in the tropics, 1.23 = 27°). The acid density should be measured with the acid at the specified level (see Section A).

d) **During the charge, the charging room should be well ventilated. No naked lights must be used, owing to the danger of explosion occasioned by the release of oxyhydrogen gas.**

5. Switch off the charger, disconnect the battery and again check the acid level.

Note: Any acid which has splashed or spilt over should be washed off with water or rendered innocuous by means of a soda solution or ammonium chloride. The battery should then be dried.

E. Re–Charging of Battery with Quick–Charging Apparatus

If a quick charge is needed, discharged batteries can be charged at a considerably higher current rate. A considerable amount of time is saved in this process since a quick charge takes only appr. half an hour. Quick-charging, however, should not be made the rule and in any case should only **be undertaken in the case of sound batteries which have already been in use and should never be undertaken at the first charge.** A quick charge should in all cases be followed by a normal charge after a short service time in order to ensure complete adaptation of the plates. Before beginning a quick charge, it is absolutely necessary to check the battery and make sure that it is in good condition. It is useless to charge defective batteries in this way since this will only increase the damage to the battery. Before charging therefore, the battery should be repaired or alternatively, replaced by a battery which is in good order.
The modern, commercially available quick-charging plants are fully automatic. The rate and duration of charge are so arranged that it is impossible for overcharging and thus overheating to take place at all. The operating instructions for the charger which is being used should in all cases be strictly adhered to.

F. Preperation of New Batteries

New batteries are generally delivered empty. Initial charging should be carried out according to the instructions issued with the battery.

The following is the general procedure adopted:

1. Unscrew the filler caps and fill the cells with chemically pure accumulator acid of a specific gravity of 1.285 = 32° Bé.
   The acid should be 10 mm over the top edge of the separators and 15 mm over the edge of the plates.

2. It is absolutely essential that the battery should then be allowed to stand for 5–6 hours so that the plates can become completely soaked in the electrolyte.

Note: The acid level decreases somewhat during this period. Before the battery is charged the acid level must be above the upper edge of the plates and should, if necessary, be topped up with acid of the same degree of density.

3. Charge the battery at a rate of 5% of the rated capacity or less until the voltage of each cell has risen to 2.6–2.7 Volts on charge and until all cells are actively gassing.

4. Measure the temperature of the battery acid from time to time. If the temperature rises above 40° C, reduce the charging rate.

5. After the charge is completed check the acid density (specific gravity 1.285 = 32° Bé at an acid temperature of +20° to 27° C) and, if necessary, correct. If it is necessary to top up the battery with acid charge the battery for a short time afterwards in order to ensure that the battery acid is well mixed and distributed.

G. Laying–Up of a Battery

If a battery is to be out of use for some time, the following procedure should be adopted:

1. Charge the battery according to the instructions (see Section C).

2. Coat the terminals and the cell connecting bars with acid-resisting grease.

3. Store the battery in a cool dry room where there is no danger of frost.

4. Discharge and re-charge the battery once a month. Never overcharge the battery. It should only be charged until all cells are actively gassing. Check the acid level.

5. Before every third re-charge first discharge the battery to 1.75 Volts per cell and then re-charge.

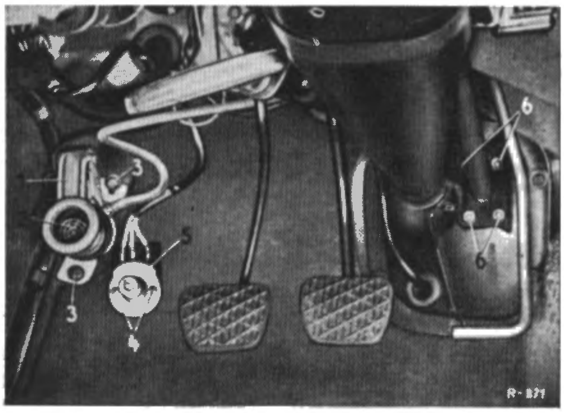
Note: A battery that is filled with acid must never be allowed to stand uncharged since the plates will soon become unserviceable through sulfation!

Removal and Installation of Foot Dimmer Switch

Job No. 54-14

Removal:

1. Detach the rubber mat at the front left toe-board and turn it back until the foot dimmer switch (5) becomes accessible (see Fig. 54-14/1).



2. Unscrew the two fixing screws (4), disconnect the electric cables and remove the foot dimmer switch (5) (Fig. 54-14/1).

Installation:

3. When connecting the electric cables, pay attention to the color coding:
   Connect as follows:
   the white/yellow cable to Terminal 56,
   the white cable to Terminal 56a,
   the yellow cable to Terminal 56b.

Fig. 54-14/1

1 Lever for windshield wiper actuation
2 Pump for windshield washer
3 Fixing screws
4 Fixing screws
5 Foot dimmer switch
6 Hexagon nuts

Removal and Installation of Left or Right Horn

Job No. 54-15

Removal:

1. Disconnect the two electric cables from the horn (3).

2. Unscrew the hexagon screw (2) (Fig. 54-15/1) and remove the horn (3) together with the flexible suspension from the bearing bracket (1).

Installation:

3. Installation is the reverse of the removal procedure.

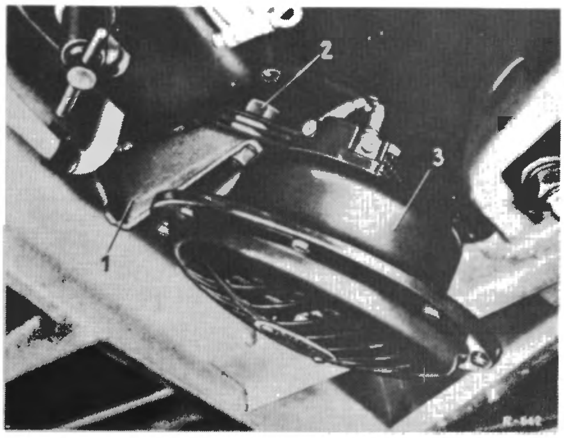


Fig. 54-15/1

1 Bearing bracket
2 Hexagon screw
3 Horn

Job No.
54-17

Removal and Installation of the Combined Switch for Flash Direction Signal and Upper Beam Flash Signal System

Removal:

1. Disconnect the ground cable at the negative terminal of the battery.

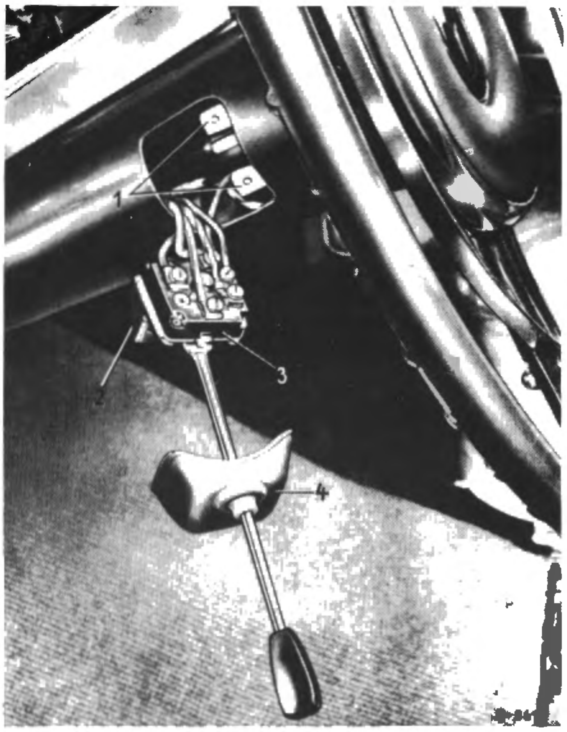


Fig. 54-17/1

1 Base in steering column jacket
2 Angle bracket
3 Switch
4 Rubber sleeve

2. Take the rubber sleeve (4) out of the steering column jacket and push it back (Fig. 54-17/1).

3. Unscrew the two cross-recess head screws on the angle bracket (2) from the base (1) of the steering column jacket.

4. Pull the switch (3) outward and disconnect the electric cables (Fig. 54-17/1).

Installation:

5. During installation pay attention to the color coding. Connect:
   the black-white-green cable to terminal 54,
   the white-green cable to terminal 31,
   the brown cable to ground,
   the black-green cable to the terminal for the right flash direction signal,
   the black-white cable to the terminal for the left flash direction signal.

Note: The black-yellow-pink cable is a direct connection between plug and horn contact.

Front Lighting Unit

A. Removal and Installation of Left or Right Lighting Unit

Removal:

1. Remove the oval head countersunk screw (1) on the ornamental ring (4) and take off the ornamental ring (Fig. 82-1/1).

Fig. 82-1/1

1 Oval head countersunk screw
4 Ornamental ring

2. Screw out the fixing screws (16) (Fig. 82-1/3) from the lighting unit and take out the lighting unit far enough for the electric plug to be pulled out.

3. Pull out the 6-pin plug (2) and the 3-pin plug (3) and take off the lighting unit (Fig. 82-1/2).

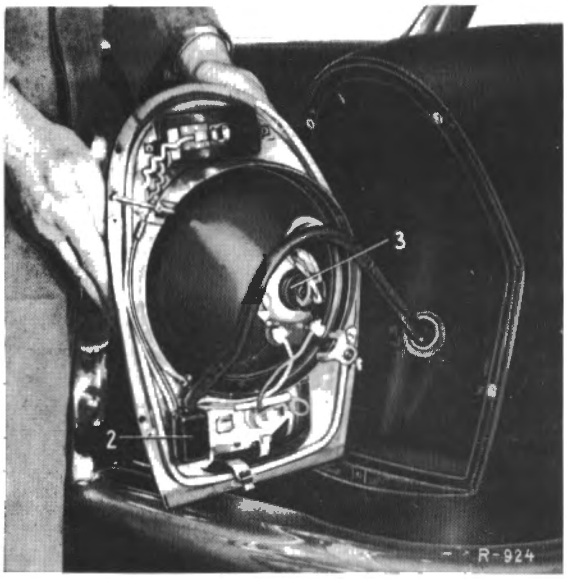


Fig. 82-1/2

2 6-pin plug
3 3-pin plug

Installation:

4. Installation is the reverse of the removal procedure.

B. Removal and Installation of Left or Right Headlight Lens

Removal:

1. Remove the ornamental ring (4) (see Section A No. 1).

2. Use a broad screw driver to turn the 6 swivel clips (17) away from the lens (21) and take out the lens (21) (Fig. 82-1/3).

Installation:

3. Installation is the reverse of the removal procedure.

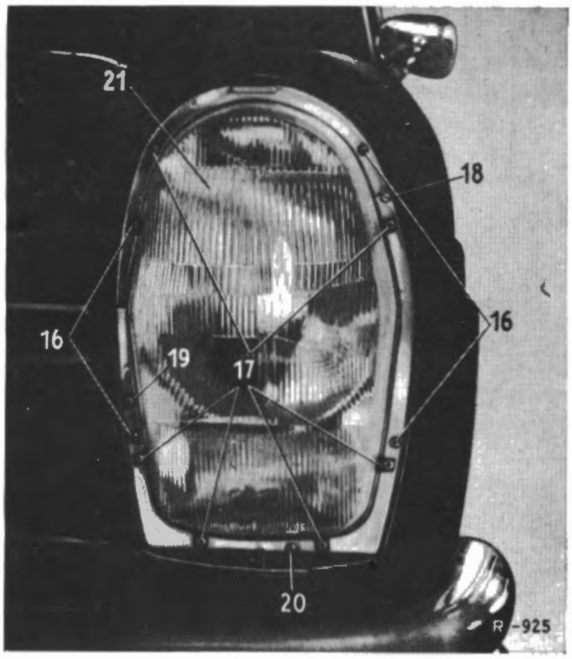


Fig. 82-1/3

16 Fixing screw for lighting unit
17 Swivel clips
18 Vertical plane adjusting screw for main headlight
19 Lateral plane adjusting screw for main headlight
20 Adjusting screw for fog light
21 Lens

C. Replacing of Bulbs for Left or Right Main Headlight and Parking Light

Removal:

1. Screw out the lampholder (5) from the bayonet catch and remove the bulb for the main headlight (6) and the bulb for the parking light (7) (Fig. 82-1/4).

Installation:

2. Installation is the reverse of the removal procedure.

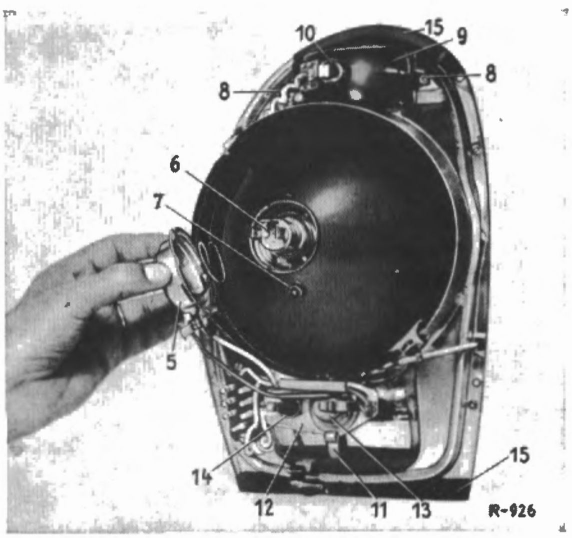


Fig. 82-1/4

5 Lampholder for main headlight and contact plate for parking light
6 Bulb for main headlight 40/45 W
7 Bulb for parking light 4 W
8 Swivel clip
9 Lampholder for flash direction signal
10 Bulb for flash direction signal 15 W
11 Retainer
12 Lampholder for fog light and clearance light
13 Bulb for fog light 35 W
14 Bulb for clearance light 35 W
15 Sealing frame

D. Replacing Bulb for Left or Right Flash Direction Signal

Removal:

1. Use a broad screw driver to turn the two swivel clips (8) away from the lampholder (9). Remove the lampholder (9) and take out the bulb (10) for the flash direction signal (Fig. 82-1/4).

Installation:

2. Installation is the reverse of the removal procedure.

E. Replacing Bulb for Left and Right Fog Light and Clearance Light

Removal:

1. Pry off the retainer (11) from the lampholder (12) for the fog light and the clearance light. Take off the lampholder (12) and take out the bulb (13) for the fog light and the bulb (14) for the clearance light (see Fig. 82-1/4).

Installation:

2. Installation is the reverse of the removal procedure.

Note: Do not touch the bulbs with bare (greasy) fingers; always use a clean cloth or a piece of tissue paper when inserting the bulbs. If this is not done, the bulbs give off a grease vapor when they become hot, and this vapor settles on the reflector and reduces its reflecting efficiency.

Job No.
82-2

Headlight Adjustment

A. Adjustment of Main Headlights

The front lighting units have headlights with an asymmetrical lower beam.

When the headlights are adjusted, a load of 70 kg must be placed in the middle of the rear seats.

The headlight adjustment device must be aligned exactly parallel to the car longitudinal axis.

The closer the adjustment device and its collecting lens is moved toward the headlight the more accurate will the adjustment be.

Headlights with asymmetrical lower beam are adjusted **only with relation to the lower beam.**

In the case of right asymmetrical lower beam the light-dark boundary runs horizontal on the left side and rises at the center at an angle of 15° toward the right (Fig. 82-2/1); in the case of left asymmetrical lower beams the picture is reversed.

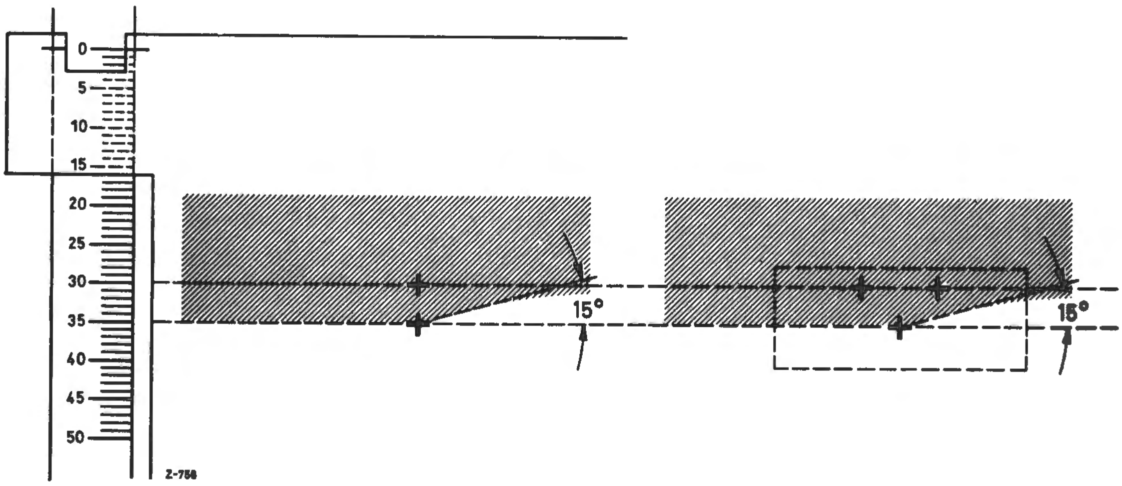


Fig. 82-2/1

Horizontal beam aiming:

Aim the headlight beams horizontally in such a way that the break in the light-dark boundary coincides with the lower cross on the adjusting screen (Fig. 82-2/1). If the break is not clearly visible the situation can be improved by covering the gusset on the left side of the diffusing lens several times by hand.

Vertical beam aiming:

The headlights are aimed vertically in such a way that the light-dark boundary runs vertically to the left of the break and coincides with the lower line of the adjusting screen (Fig. 82-2/1).

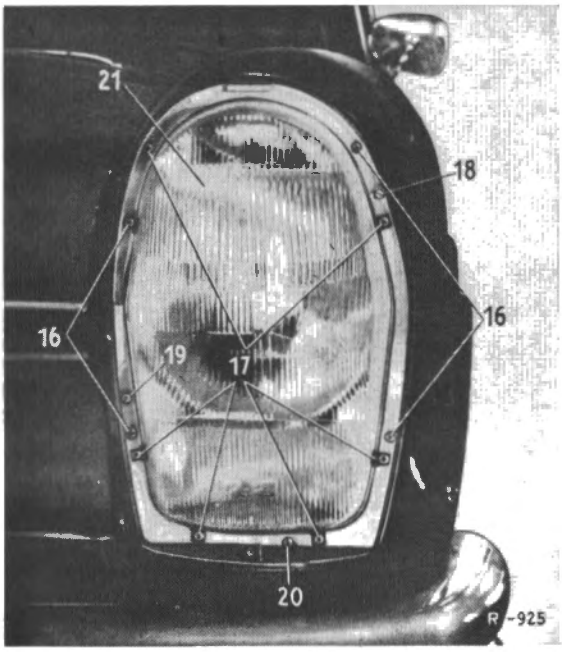


Fig. 82-2/2

16 Fixing screw for lighting unit
17 Swivel clip
18 Vertical plane adjusting screw for main headlight
19 Lateral plane adjusting screw for main headlight
20 Adjusting screw for fog light
21 Lens

B. Adjustment of Fog Lights

1. Place a load of 70 kg in the middle of the rear seats.

2. Put the car 5 m from the adjusting screen.

3. On the adjusting screen mark the height H of the fog lights. Underneath this draw in the adjusting line at the specified distance (h) marked on the lens of the fog lights (Fig. 82-2/4).

   For the fog light in the lighting unit the distance (h) is 12 cm.

4. Adjust the fog lights in such a way that the adjusting line lies in the center of the most brightly illuminated area of the adjusting screen (see Fig. 82-2/4).

Note: Check each fog light separately, cover the other while doing this.

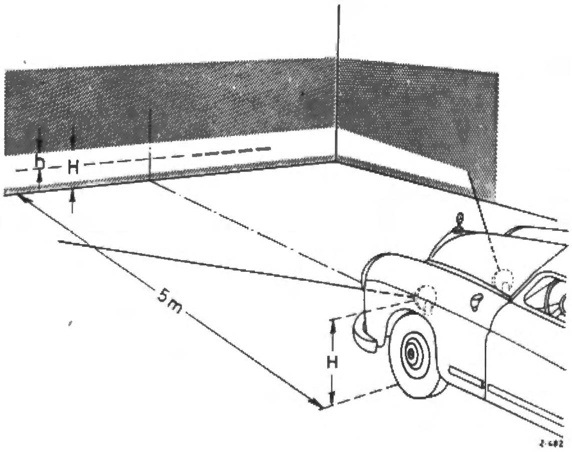


Fig. 82-2/4

Job No.
82-4

Windshield Wipers

A. Removal and Installation of Windshield Wiper Motor

Removal:

1. Remove the right cover under the instrument panel.
2. Detach the short link (1) from the motor crank (2) by removing the snap ring and the washer (4) (Fig. 82-4/1).

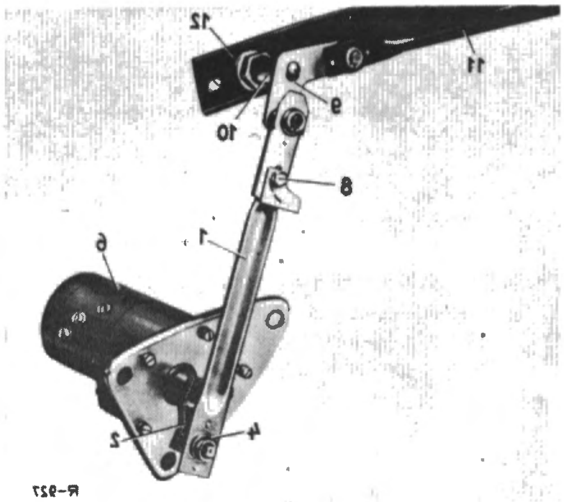


Fig. 82-4/1

1 Link	9 Tandem lever
2 Motor crank	10 Adjusting gage
4 Washer	11 Long link
6 Wiper motor	12 Holding plate
8 Locking screw	13 Wiper shaft

3. From the engine compartment pull out the 6-pin plug (7), screw out the fixing screws (5) and remove the wiper motor (6) (82-4/2).

Installation:

4. Fit the wiper motor (6) and screw on by means of the fixing screws (5) (Fig. 82-4/2).

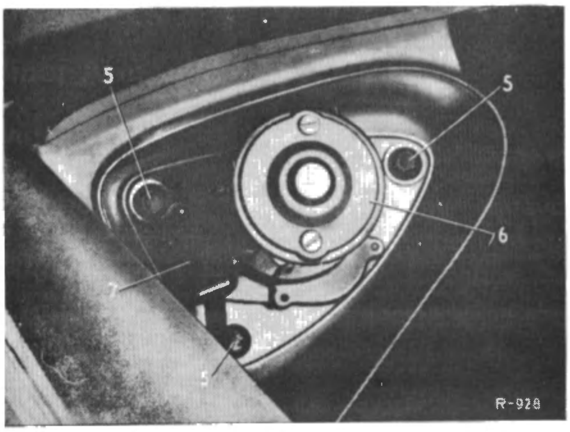


Fig. 82-4/2

5 Fixing screws
6 Wiper motor
7 6-pin plug

5. Insert the 6-pin plug (7) and put the wiper motor into the parking position by switching it on and off quickly.

Note: If only the wiping motor has to be replaced, the linkage should not be adjusted in any way. In particular the locking screw (8) on the short link (1) (Fig. 82-4/1) must not be loosened since otherwise complete readjustment of the drive linkage becomes necessary.

6. Attach the short link (1) to the motor crank (2) together with washer (4) and snap ring (Fig. 82-4/1).
7. Install the right cover below the instrument panel.

B. Removal and Installation of Wiper Arm with Wiper Blade

Removal:

1. Unscrew the cap nut and remove together with spring washers.
2. Remove the wiper arm together with wiper blade.

Installation:

3. Installation is the reverse of the removal procedure; make sure that in the parking position the left wiper arm is below the right arm.

Note: The wiper shaft has a serrated cone and the wiper arm is mounted on this cone. The inner cone of a new wiper arm has no serrations. When the cap nut is tightened the serrations on the wiper shaft bite into the inner cone of the wiper arm. This guarantees better adjustment of the wiper arms. If necessary the serrations in the inner cone of the wiper arm can be eliminated as follows; lightly mount the wiper arm on the wiper shaft and move it toward the right and the left until the serrations on the wiper arm have been evened out by the serrations on the wiper shaft.
Then readjust the wiper arm and firmly tighten the cap nut so that the serrations bite into the inner cone of the wiper arm in the new position.

C. Removal and Installation of Left or Right Wiper Blade of Windshield Wiper

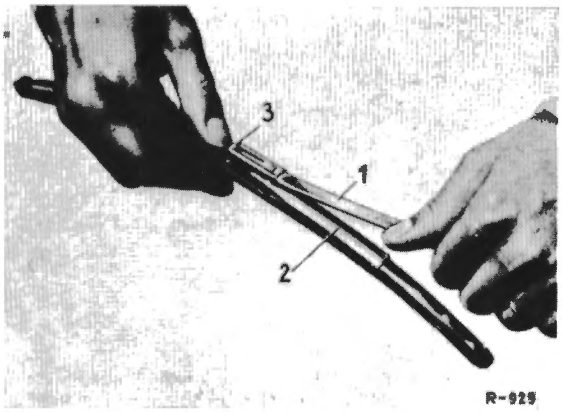


Fig. 82-4/3

1 Wiper arm
2 Wiper blade
3 Retaining spring

Removal:

1. Lift the wiper arm (1) with the wiper blade. Press down the retaining spring (3) on the wiper blade (2) and remove the wiper blade (2) in the direction indicated by the arrow (Fig. 82-4/3).

Installation:

2. Install the wiper blade (2) on the wiper arm (1) in the reverse direction and push it in until the retaining spring (3) is heard to click into position.

D. Removal and Installation of Rubber Blade

Removal:

1. Remove the wiper blade (see Section C).

2. Push out the rubber blade (1) together with the two retaining springs (2) at the one end of the anchorage in the wiping blade (3) in the direction indicated by the arrow (Fig. 82-4/4).

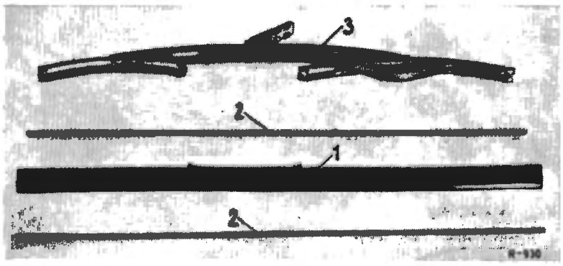


Fig. 82-4/4

1 Rubber blade
2 Retaining spring
3 Wiper blade

3. Pull out the two retaining springs (2) (Fig. 82-4/4).

4. Carefully take the rubber blade (1) out of the anchorage of the wiper blade (3) (Fig. 82-4/4).

Installation:

5. Loosely insert the rubber blade (1) into the one anchorage of the wiper blade (3) without retaining springs (2). Leave the long end free.

6. Carefully insert the two retaining springs (2) into the rubber blade (1) (see Fig. 82-4/5).

7. Slide the free end of the rubber blade (1) together with the retaining springs (2) into the other anchorage of the wiper blade (3) (Fig. 82-4/4).

8. Install the rubber blade (see Section C).

E. Removal and Installation of Push-Pull Switch for Windshield Wipers

Removal:

1. Remove the left cover from under the instrument panel.

2. Unscrew the control knob and the escutcheon from the push-pull switch.

3. Reaching behind the instrument panel take out the push-pull switch.

4. Pull off the plug from the push-pull switch.

Installation:

5. Installation is the reverse of the removal procedure.

F. Removal and Installation of Windshield Wiper Linkage with Plate

Model 230 SL

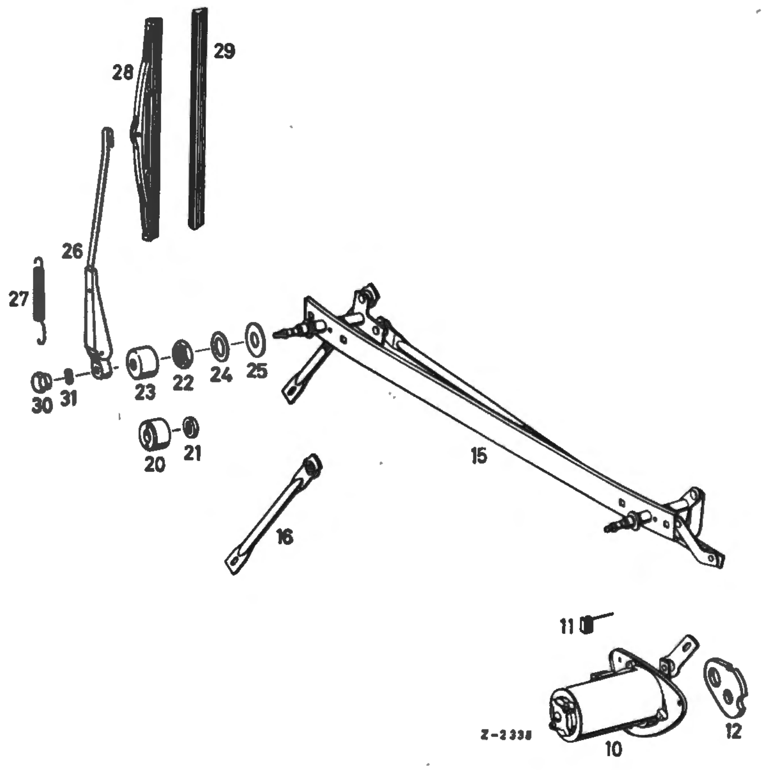


Fig. 82-4/5

10 Wiper motor
11 Carbon brush
12 Base plate
15 Windshield wiper linkage with plate
16 Adjustable drive rod
20 Cap nut } 1st version
21 Sealing ring } 1st version
22 Hexagon nut } 2nd version
23 Capsule } 2nd version
24 Washer } 2nd version
25 Washer } 2nd version
26 Wiper arm
27 Tension spring
28 Wiper blade
29 Rubber blade
30 Cap nut
31 Corrugated washer

Removal:

1. Remove the glove compartment (see Job No. 68-1).

2. Remove the clock (see Job No. 54-12, Section B).

3. Detach the cables for the operating system for heating and ventilation (see Job No. 83-2, Section A).

4. Remove the distribution box (see Job No. 83-2, Section B).

5. Remove the right defroster nozzle (see Job No. 83-2, Section E).

6. Remove the steering wheel (see Job No. 46-2).

7. Remove the support and pedals (see Job No. 29-1, Section B).

8. Remove the left defroster nozzle (see Job No. 83-2, Section F).

9. Remove both wiper arms with blades (see Section B).

10a. Use the special wrench to unscrew the cap nut (20) (Fig. 82-4/6) and remove together with the sealing ring. (1st version).

10b. Take off the capsule (23). Unscrew the hexagon nut (22) and remove together with the washers (24) and (25). (2nd version.)

11. Unscrew the windshield wiper linkage together with the plate from the front wall and remove (Figs. 82-4/5 and 7).

Installation:

12. Installation is the reverse of the removal procedure.

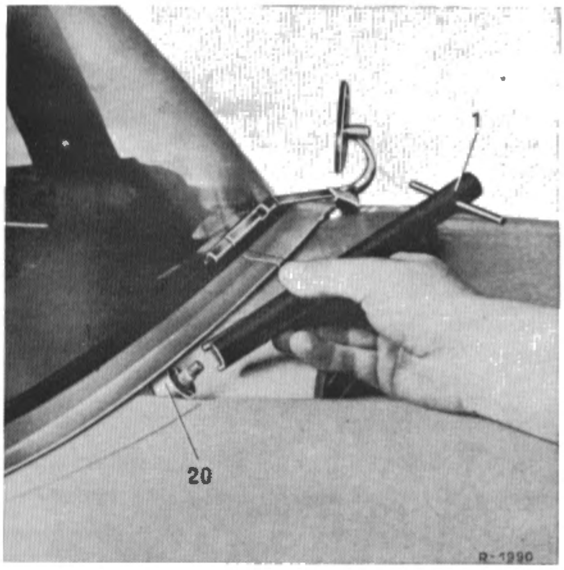


Fig. 82-4/6

1 Special wrench
20 Cap nut

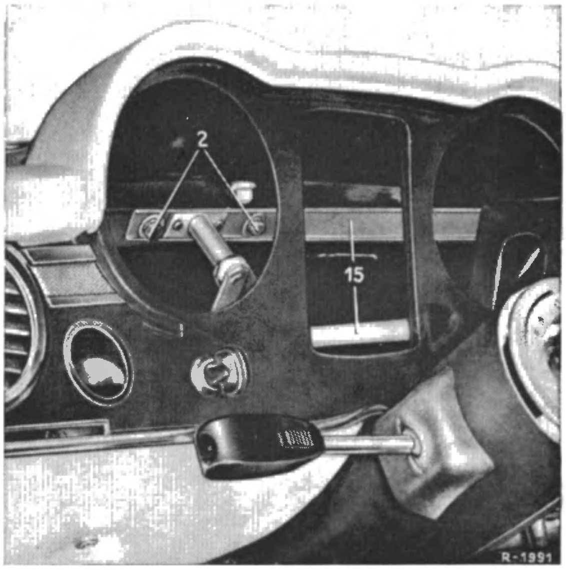


Fig. 82-4/7

2 Plate fixing screws
15 Windshield wiper linkage with plate

Job No.
82-5

Removal and Installation of Windshield Washer

Removal:

1. Take out the left rubber mat on the front floor.

2. Unscrew the oval-head screws at the left front wall insulating panel and take out the insulating panel.

3. Pull off the suction hose from the foot pump and screw out the two fixing screws (3) (Fig. 82-5/1).

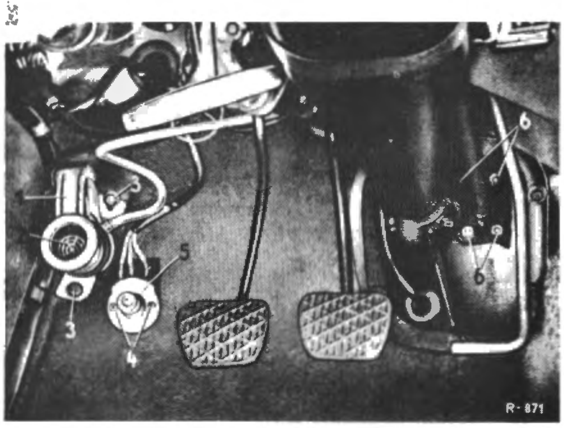


Fig. 82-5/1

1 Lever for windshield wiper operation
2 Pump for windshield washer
3 Fixing screws
4 Fixing screws
5 Foot dimmer switch
6 Hexagon nuts

4. Remove the foot pump and pull out the plug.

5. Remove the water container and the hoses in the engine compartment and the spray nozzles at the engine hood.

Installation:

6. Installation is the reverse of the removal procedure.

Note: A nozzle needle is supplied for the adjustment of the nozzles and for cleaning blocked nozzles. This needle is in a plastic box together with the spare fuses in the tool bag.

7. Adjust the spray nozzles as follows: Insert the nozzle needle into the nozzle opening about 2 mm, and adjust the ball nozzle in such a way that the water jet is given the desired direction.

8. Dilute 1 part Mercedes-Benz windshield cleaning fluid in 12 parts of water and mix well. Pour this solution into the water container (water container capacity appr. 1.2 liters).

Note: In winter dilute 1 part Mercedes-Benz concentrate in 6 parts of water and mix well. This solution does not freeze at temperatures down to – 9° C. This solution is also suitable for cleaning smeared (greasy) windshields.
Caution! Any concentration of the fluid higher than the one given above will attack the car finish.

Removal and Installation of Combined Left or Right Rear Light

Job No.
82-13

The large rear light designated "a" is installed in Models 220 SE and 220 SEb. The small rear light designated "b" is installed in Model 220 b. Since the procedure for removing and installing the two rear lights is essentially the same the following text refers to both rear light "a" and rear light "b".

Removal:

1. Pull out the six-pin plug (1) and in the case of rear light "b" also the two-pin plug (2) from the housing (3) of the rear light (see Figs. 82-13/1a and 82-13/1b).

2. Screw out the fixing nuts (4) and remove the lamp housing together with the sealing frame (Figs. 82-13/1a and 82-13/1b).

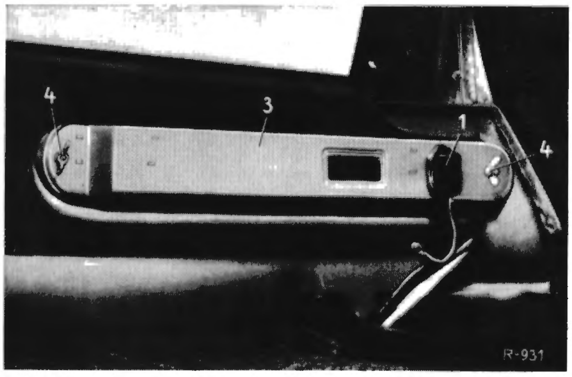


Fig. 82-13/1a

1 Six-pin plug
2 Lamp housing
3 Fixing nut

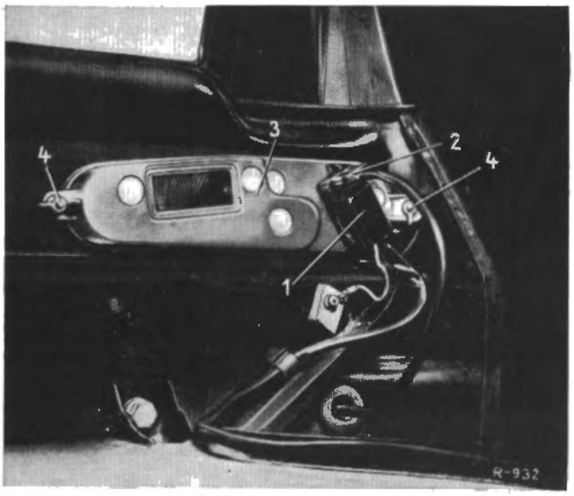


Fig. 82-13/1b

1 Six-pin plug
2 Town-pin plug
3 Lamp housing
4 Fixing nut

3. If necessary replace the bulbs (see Figs. 82-13/2a and 82-13/2b).

Installation:

4. Installation is the reverse of the removal procedure.

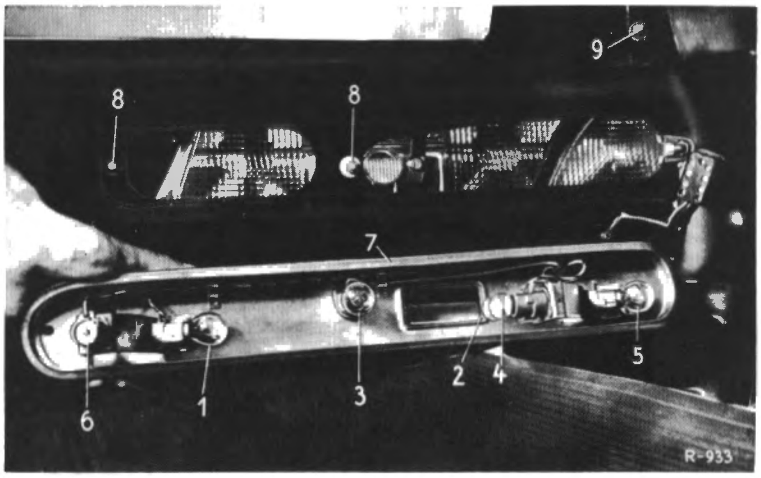


Fig. 82-13/2a

Models 220 Sb, 220 SEb

1 Bulb for brake light 15 W
2 Bulb for clearance light 3 W
3 Bulb for reversing light 15 W
4 Bulb for tail light 5 W
5 Bulb for flash direction signal 15 W
6 Bulb for license plate light 10 W
7 Sealing frame inside
8 Fixing nut for cover
9 Fixing nut for embellisher

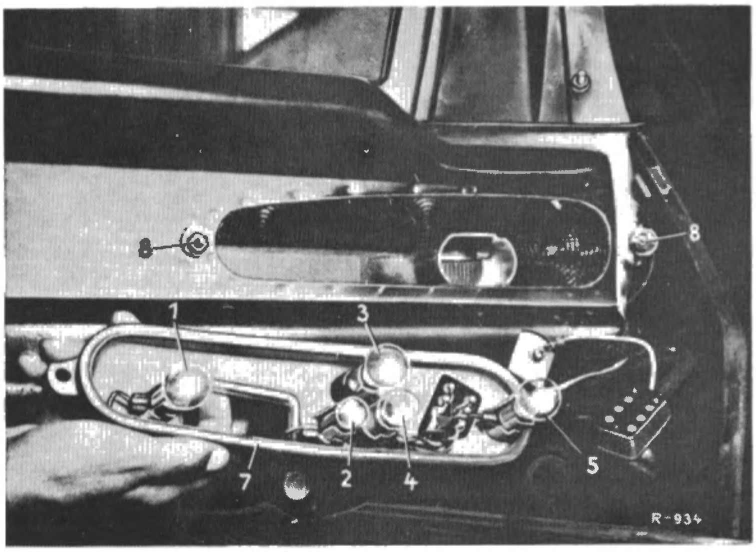


Fig. 82-13/2b

Typ 220 b

1 Bulb for brake light 15 W
2 Bulb for clearance light 3 W
3 Bulb for reversing light 15 W
4 Bulb for tail light 5 W
5 Bulb for flash direction signal 15 W
7 Sealing frame inside
8 Fixing nut for cover
9 Fixing nut for embellisher

Job No.
82-15

Removal and Installation of Rotary Light Switch

Removal:

1. Remove the left insulating panel from below the instrument panel (see Job No. 68-3).

2. Pull out the rotary light switch control knob. Screw out the escutcheon by means of a hooked wrench and pull out the control knob completely.

3. Reach behind the instrument panel and pull out the rotary light switch toward the front.

4. Disconnect the electric cables.

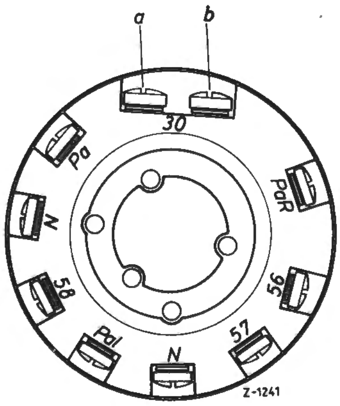


Fig. 82-15/1

Installation:

5. Connect the electric cables to the rotary light switch. When doing this pay attention to the color coding and connect as follows:

   The red cable (4 mm² section) and the red cable (2.5 mm² section) to "a" of terminal 30.

   The red cable (1 mm² section) (lead No. 5) to "b" of terminal 30. The two green cables (1 mm² section) to terminal PaR.
   The white-yellow cable (2.5 mm² section) to terminal 56.

   The grey-green-yellow cable (2.5 mm² section) to one of the two terminals N.

   The two grey-green cables (1.5 mm² section) to the other terminal N.

   The red-green cable (1 mm² section) to terminal Pa.

   The two green-black cables (1 mm² section) to terminal PaL.

   The grey cable (1.5 mm² section) to terminal 58.

   Terminal 57 should remain free.

6. The remaining installation operations are the reverse of the removal procedure.

Interference Suppressors for Radio

Job No.
82-20

Modification: Arrangement of Interference Suppressors (Figs. 82-20/1 to 6) added

Good radio reception can only be obtained when the following intructions for interference suppression are carefully adhered to. The total resistance in the ignition circuit should be between 13 k Ω and a maximum of 16 k Ω. If the resistance values are higher, ignition performance will be reduced excessively with the result that misfiring may occur at high engine speeds.

Interference suppressors	optional		Remarks
	Bosch Part No.	Beru Part No.	
1. Spark plugs with suppressors (5 k Ω)	see spark plug table		**Use only approved spark plugs**
2. Spark plug suppressor caps (angular form) (1 k Ω)	EM/W1/11 000 156 15 10	OE 4/1 000 156 16 10	190 c, 220 b, 220 Sb
Spark plug suppressor cap (straight form) (1 k Ω)	EM/W 1/14 000 159 12 42	BE 4/1 000 159 13 42	220 SEb
3. Spark plug suppressor cap (1 k Ω)	EM/W 1/20 000 156 17 10	VES 1 K 000 156 18 10	
4. Water protective caps	Bosch type —	G 1 PL 000 159 07 85	
5. Distributor rotor arm with interference suppression (5 k Ω)	ZVVZ 5 Z 5 Z 000 158 11 31	EVL 4/6 Z —	
6. Suppressor condenser with insulated return cable to ignition coil terminal 15	EMKO 20 Z 1 Z 3 MF 000 156 29 01	SK 215 L 3 MF 000 156 31 01	Fig. 82-20/1

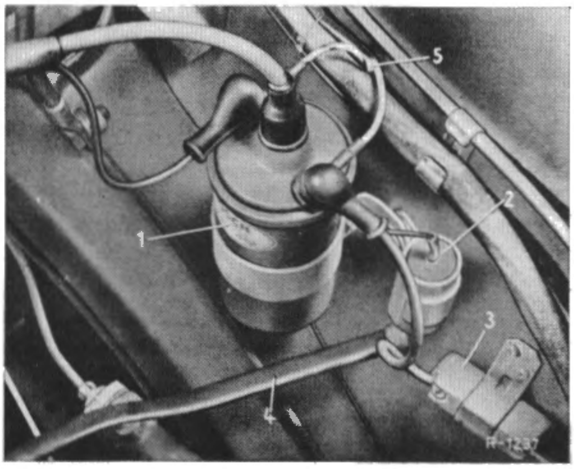


Fig. 82-20/1

1 Ignition coil
2 Suppressor condenser to ignition coil terminal 15
3 Series resistance
4 Ground cable to engine block
5 Connection cable for electric revolution counter

7. Regulator cut-out switch with spot-welded ground straps. If a radio is installed subsequently it is necessary to suppress the standard regulator cut-out switch with two additional ground straps Part No. 180 540 03 41 (Fig. 82-20/2).

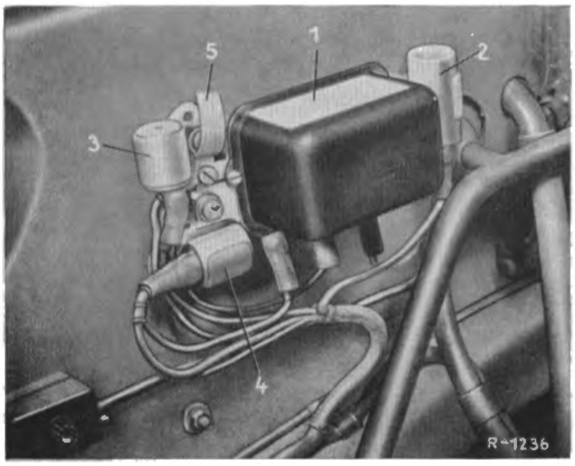


Fig. 82-20/2

1 Regulator cut-out switch
2 Feed-through condenser at regulator terminal 51
3 Choke and condenser suppressor at regulator terminal DF
4 Feed-through condenser at regulator terminal 61
5 Ground strap 180 540 03 41

Interference suppressors	optional		Remark
	Bosch Part No.	Beru Part No.	
8. Feed-through condenser at regulator terminal 51	EMKO 21 Z 2 Z 2.5 MF 000 156 37 01	SK 211 R 3 MF 000 156 20 01	Fig. 82-20/2
9. Feed-through condenser at regulator terminal 61	EMKO 21 Z 1 Z 0.5 MF 000 156 26 01	SK 219 R 0.5 MF 000 156 33 01	Fig. 82-20/2
10. Choke and condenser suppressor at regulator terminal DF	EM/SD 3/1 0.005 MF 000 156 28 01	—	Fig. 82-20/2
11. Feed-through condenser at terminal Dt of the generator	EMKO 21 Z 1 Z 0.5 MF 000 156 26 01	SK 210 R 0.5 MF 000 156 30 01	Fig. 82-20/3

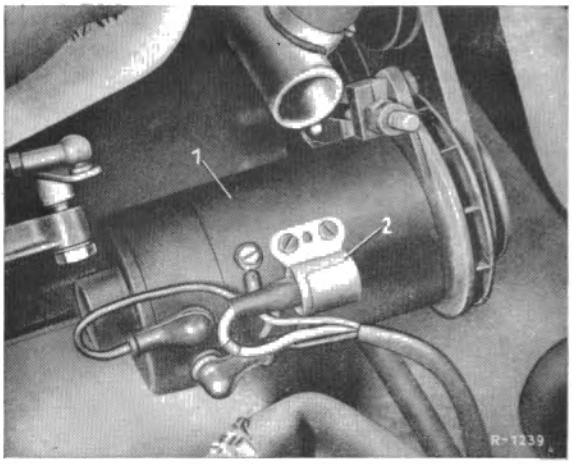


Fig. 82-20/3

1 Generator
2 Feed-through condenser at terminal Dt of the generator

12. 1 Ground strap Part No. 10 120 820 00 72 between capillary tube of the radiator thermometer and the cowl (Fig. 82-20/4).

13. 1 Ground strap Part No. 10 120 820 00 72 between choke control and cowl (Fig. 82-20/4).

14. 1 Ground strap Part No. 180 540 00 41 between speedometer drive shaft and cowl (Fig. 82-20/4).

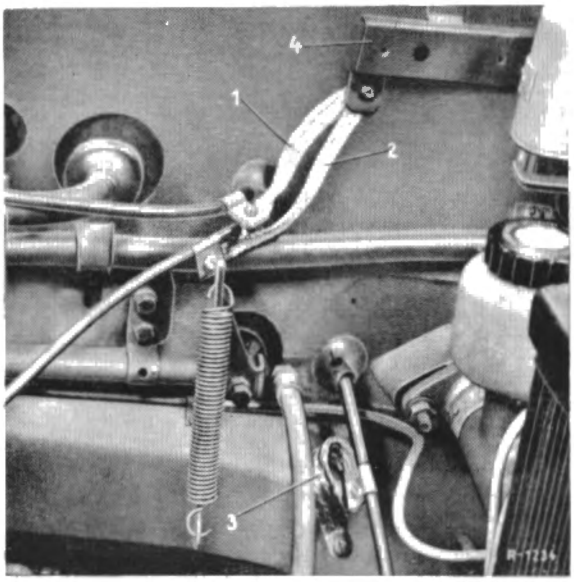


Fig. 82-20/4

1 Ground strap between choke control and cowl
2 Ground strap between capillary tube of the radiator thermometer and cowl
3 Ground strap betwoen speedometer drive shaft and cowl
4 Relay bracket

15. 1 Ground strap Part No. 180 540 01 41 from ground connection of the condenser at the ignition coil to the engine (Figs. 82-20/1 and 82-20/5).

16. 1 Ground strap Part No. 111 540 00 41 from the engine to the left radiator mounting (Fig. 82-20/5).

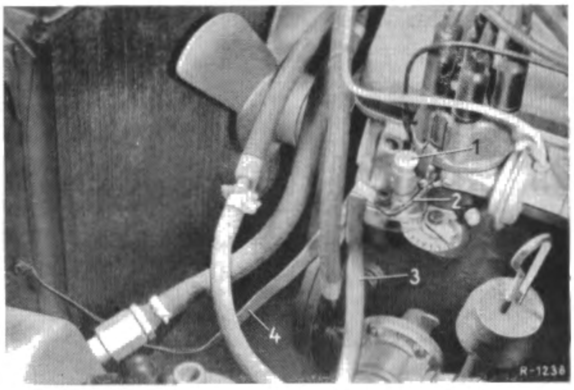


Fig. 82-20/5

1 Ignition condenser at distributor
2 Ground strap from distributor to engine block
3 Ground strap from engine block to ignition coil
4 Ground strap from engine block to radiator mounting

17. 1 Ground strap Part No. 180 540 04 41 from the hood to the cowl (Fig. 82-20/6).

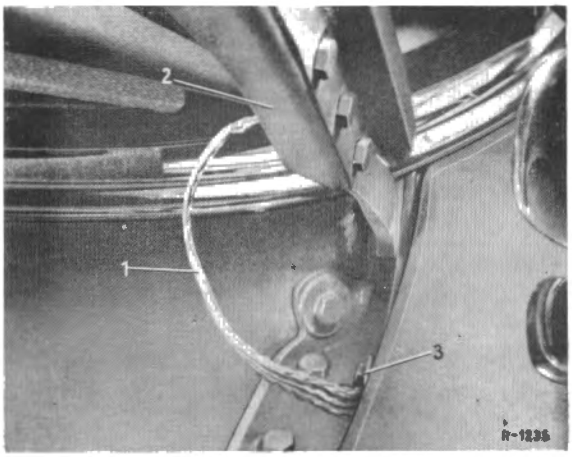


Fig. 82-20/6

1 Ground strap between hood and cowl
2 Hood
3 Connection at cowl

18. 2 Complete wheel hub contacts for the front wheels.

Note: In order to enable the ground straps to be tightened properly an ordinary washer should be installed in addition to the spring washer.

Windows – Group 67

Panels – Group 68/69

Front and Rear Doors – Group 72/73

Rear Compartment Lid – Group 75

Sliding Roof – Group 78

Tops – Group 79

Windshield with Garnish Molding and Reveal Molding

Job No. 67-1

A. Removal and Installation of Lower Left and Right Windshield Garnish Molding

Removal:

1. Remove the fixing nut (1) for the garnish molding (2) at the lower left and right of the windshield (Fig. 67-1/1).

Fig. 67-1/1

1 Fixing nut
2 Lower left garnish molding at windshield

2. Use a folding rule or a flat piece of wood (3) to lift the garnish molding left and right out of the press fasteners and remove it. Before doing this carefully push the covering of the center joint aside (Fig. 67-1/2).

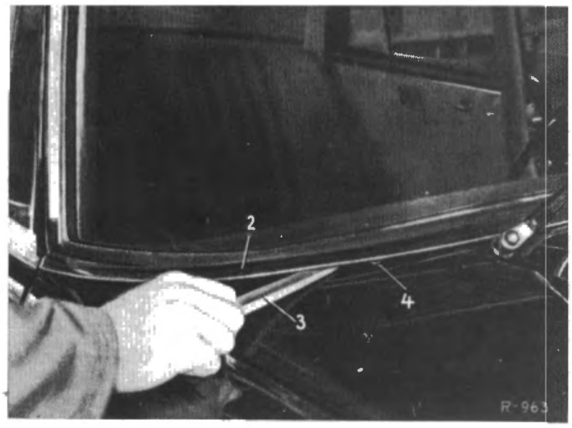


Fig. 67-1/2

2 Garnish molding
3 Flat piece of wood
4 Press fastener

Installation:

3. Insert the upper part of the press fasteners (6) in the retaining plates (5) of the garnish molding (2) (Fig. 67-1/3).

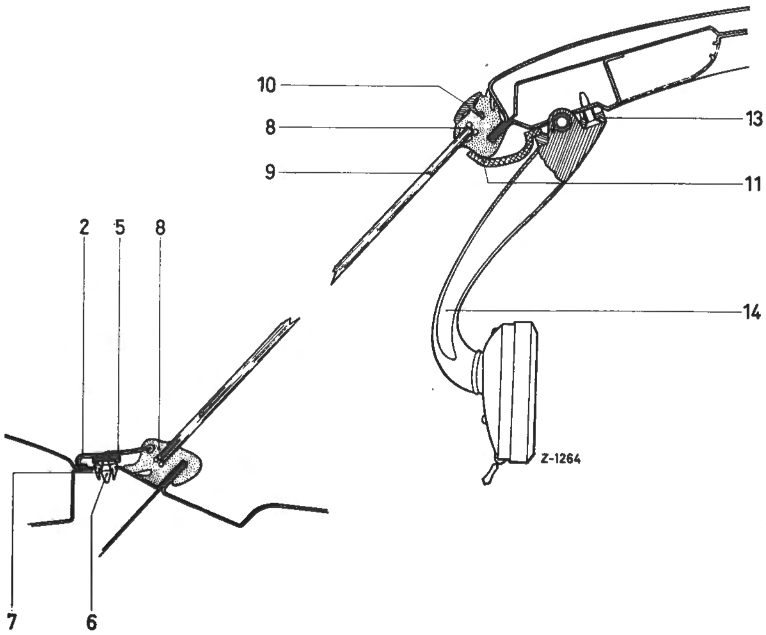


Fig. 67-1/3

2 Lower garnish molding
5 Retaining plate
6 Press fastener, upper part
7 Press fastener, lower part
8 Rubber molding
9 Windshield glass
10 Ornamental frame
11 Upper reveal molding
13 Retaining plate for rear view mirror
14 Rear view mirror

4. Insert the lower part of the press fasteners (7) in the fixing holes below the windshield glass.

5. Push the covering for the joint onto the left or right garnish molding.

6. Position the left and right garnish molding in such a way that the bolt at the outer end fits the fixing hole in the front fender (see Fig. 67-1/1) and that the upper parts (6) and the lower parts (7) of the press fasteners are aligned (Fig. 67-1/4; do not press them together yet).

7. Use a folding rule to lift the rubber lip of the rubber molding (8) over the garnish molding (2) and press the press fasteners together by a slight pressure on the garnish molding.

8. When the right and left garnish molding have been installed, carefully push the covering over the joint.

9. Screw in the fixing nut (1) together with the washer and lock washer underneath the front fender (see Fig. 67-1/1).

B. Removal and Installation of Windshield Reveal Molding

Removal:

1. Take the rear view mirror (14) out of the retaining plate (13) (see Fig. 67-1/3).

Note: The base of the rear view mirror has a spring lock.

2. Unscrew the retaining plate (13) for the rear view mirror.

3. Unscrew and remove the upper right and upper left reveal molding.

4. Unscrew the three fixing nuts (6) for the right lower reveal molding and the two fixing nuts for the left lower reveal molding and remove the reveal moldings (Fig. 67-1/4).

Installation:

5. Installation is the reverse of the removal procedure.

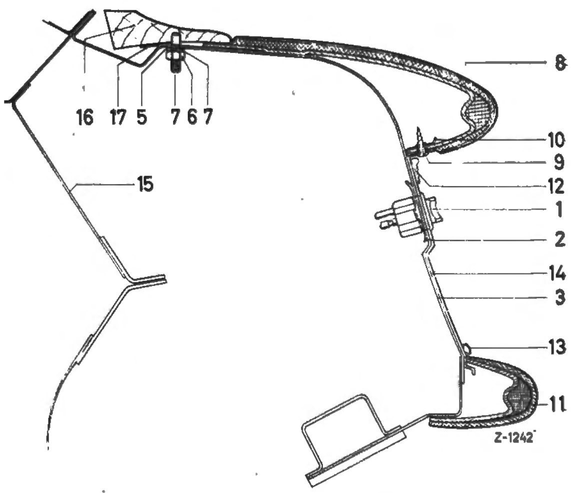


Fig. 67-1/4

1 Toggle switch
2 Clamping springs
3 Instrument panel
5 Washer
6 Fixing nut with lock washer
7 Threaded pin
8 Upper padding
9 Countersunk tapping screw
10 Clip-on nut
11 Lower ~~padding~~
12 Upper garnish molding
13 Lower garnish molding
14 Instrument panel cover
15 Front wall
16 Reveal molding
17 Felt base

C. Removal and Installation of Windshield

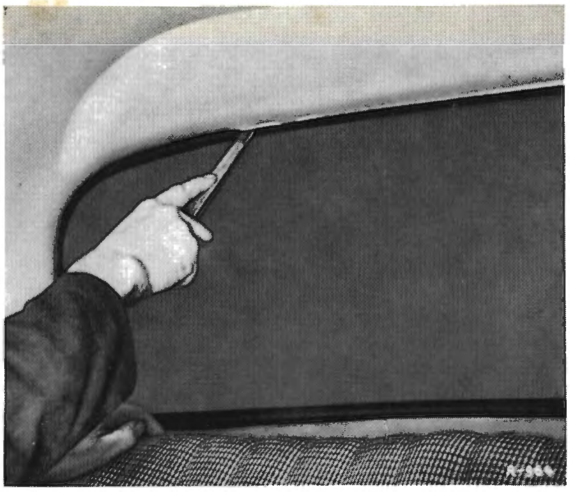
Removal:

1. Remove the windshield reveal molding (see Section B).

2. Remove the left and right lower windshield garnish molding (see Section A).

3. Use a flat piece of wood to push the rubber lip of the rubber molding from the inside behind the sheet metal edge (Fig. 67-1/5).

4. Carefully remove the windshield glass together with the rubber molding from the outside; if necessary, apply slight pressure from the inside.



Shown at back window

Fig. 67-1/5

5. Carefully remove the ornamental frame from the rubber molding and then remove the rubber molding from the windshield glass.

Installation:

6. Put the windshield glass, convex side down, on a suitable soft surface and install the rubber molding on the windshield glass (Fig. 67-1/6).

Note: Scrupulous cleanliness is required in handling the glass in order to prevent scratches.

7. Turn the windshield glass over and run a folding rule through the garnish molding groove along the rubber molding in order to clear the groove.

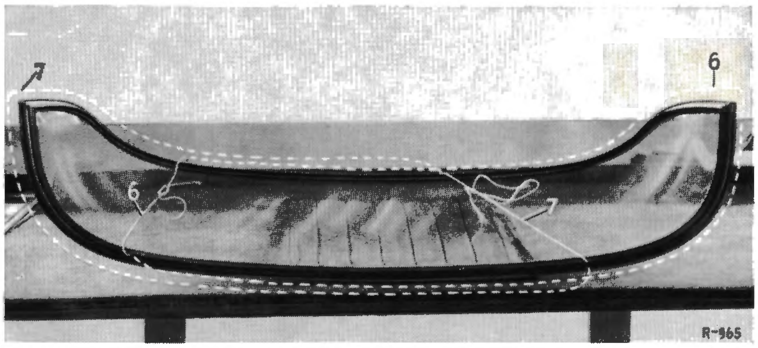
8. Coat the retaining section of the ornamental frame (10) with soapy water and carefully press the retaining section into the receiving groove of the rubber molding (8) (see Fig. 67-1/3).

9. Turn the windshield over and install two enamelled cables or two greased cords (6 and 7) into the retaining groove of the rubber molding and lightly rub the rubber molding with glycerine or tallow (Fig. 67-1/6).

Fig. 67-1/6

(Shown at back window)

6 Greased cord
7 Greased cord



Shown at back window

Fig. 67-1/7

10. Coat the spot-weld flange around the windshield opening with sealing cement BO 375/10 and fit the windshield glass together with the rubber molding into the windshield opening from the outside and position it accurately since later adjustments are not possible. Then press it home under slight pressure while at the same time an assistant lifts from the inside the rubber lip of the rubber molding over the spot-weld flange of the windshield opening by carefully pulling out the greased cord (6 and 7) or the enamelled cable.

The cable or cord must always be pulled out in the direction parallel to the glass in order to avoid damage to the rubber lip (Fig. 67-1/7).

Fig. 67-1/8

11. Press window sealing cement BO 375/10 between windshield glass and rubber molding to provide a tight seal (Fig. 67-1/8).

12. Install the right and left lower windshield garnish molding (see Section A).

13. Install the windshield reveal molding (see Section B).

Windshield with Garnish Molding and Reveal Molding

Job No. 67-2

Models 250 S, 250 SE, 300 SEb, 300 SEL

A. Removal and Installation of Lower Left and Right Windshield Garnish Molding

Removal:

1. Unscrew the screw (1) on the door box pillar (Fig. 67-2/1).

2. Slide a plastic or wooden wedge between the rubber seal and the garnish molding and press the garnish molding out of the clips (2) **toward the front** by tilting the wedge (see Fig. 68-3/1).

Installation:

3. Installation is the reverse of the removal procedure.

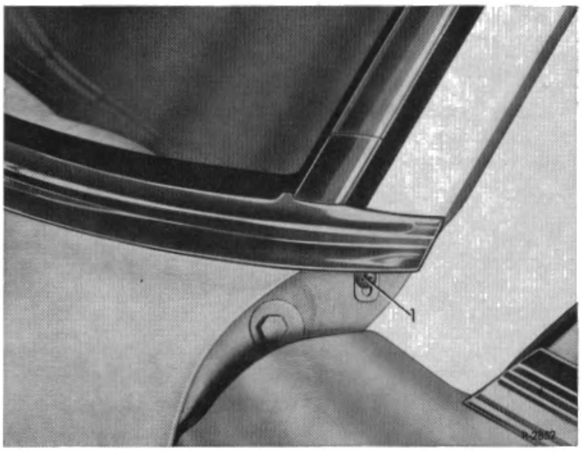


Fig. 67-2/1

1 Fixing screw for garnish molding

B. Removal and Installation of Windshield Reveal Molding

Removal:

1. Remove the left and right cover under the instrument panel.

2. Remove the left and right reveal moldings from the door box pillar.

3. Remove the glove compartment (see Job No. 68-2).

4. Back out the two plastic nuts on the right reveal molding and remove the reveal molding.

Note: The most suitable tool for backing out the plastic nuts is Knurled Socket Wrench 110 589 03 09 00 (SW 9).

5. Back out the plastic nut on the left reveal molding (right left). Lift the reveal molding to release the threaded bolt and pull it out of its mounting toward the right.

Installation:

6. Installation is the reverse of the removal procedure.

C. Removal and Installation of Windshield

See Job No. 67-1, Section C.

Job No.
67-3

Back Window with Garnish Molding

A. Removal and Installation of Lower Left and Right Back Window Garnish Molding

Removal:

1. Unscrew the left and right fixing screw at the end of the garnish molding at the left and the right (beside the striker for the rear door).

2. Further removal is essentially the same as described for the windshielt garnish molding under Job No. 67-1, No. 2.

Installation:

3. See Job No. 67-1, Nos. 3 to 8.

4. Screw in the fixing screw at the right and the left at the end of the garnish molding (beside the striker for the rear door).

B. Removal and Installation of Back Window

Removal:

1. Remove the lower left and right garnish molding of the back window (see Section A).

2. Subsequent removal procedures are essentially the same as described for the windshield in Job No. 67-1, Section C, Nos. 3 to 5.

Installation:

3. Installation is essentially the same as described for the windshield in Job No. 67-1, Section C, Nos. 6 to 13.

4. Install the left and right lower back window garnish molding.

Removal and Installation of Glove Compartment

Job No. 68-1

Model 230 SL

Removal:

1. Remove the right cover under the instrument panel (4 screws).

2. Detach the two cables (2) from the cable connector (1) for the glove compartment reading light (Fig. 68-1/1).

3. Detach the cover (1) for the glove compartment bottom along the front side and use a short special screw driver (3) to unscrew the four oval head countersunk screws (2) attaching the glove compartment (Fig. 68-1/2).

4. Also unscrew the three countersunk screws (4) for attaching the glove compartment at the top using the same short special screw driver.

5. Close the glove compartment lid and lift out the glove compartment.

Installation:

6. Installation is the reverse of the removal procedure. After screwing on the glove compartment stick down the cover for the glove compartment bottom with Dekalin adhesive.

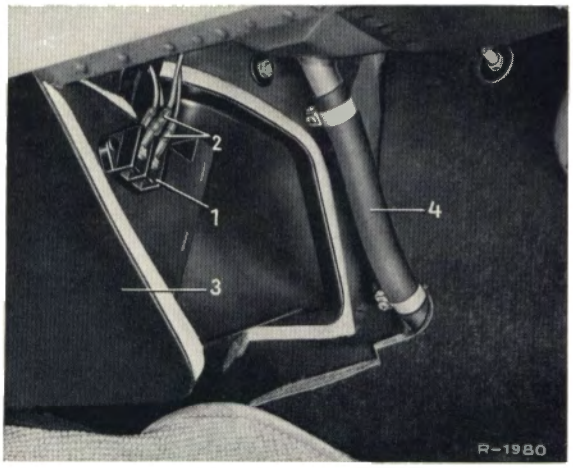


Fig. 68-1/1

1 Cable connector
2 Cable for reading light (glove compartment)
3 Center cover
4 Water drain hose

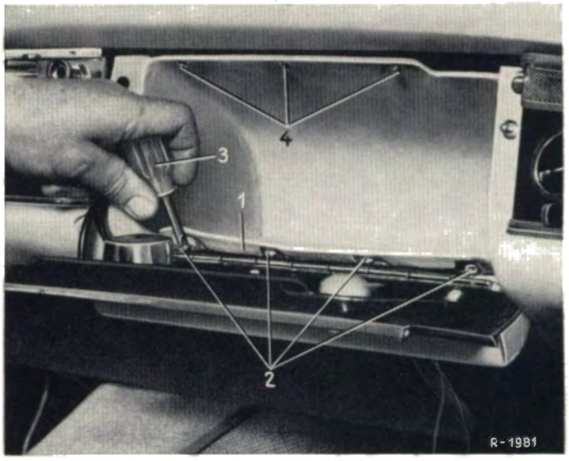


Fig. 68-1/2

1 Cover for glove compartment bottom
2 Oval head countersunk screws
3 Screw driver (Dowidat 149 KPV/02)
4 Countersunk screws

Removal and Installation of Glove Compartment

Job No.
68-2

Models 250 S, 250 SE, 300 SEb, 300 SEL

Removal:

1. Unscrew the glass cover of the glove compartment light and take out the bulb.

2. Screw out the fixing screws (6) of the glove compartment and remove the compartment toward the interior of the car.

Installation:

3. Installation is the reverse of the removal procedure.

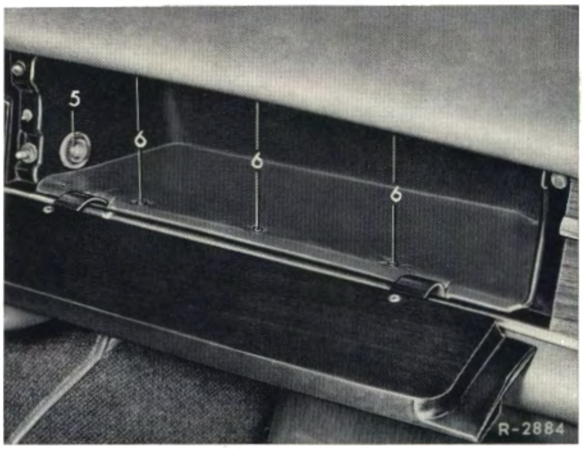


Fig. 68-2/1

5 Glass cover of glove compartment light
6 Fixing screws

Padding on Instrument Panel

Job No.
68-3

Models 250 S, 250 SE, 300 SEb, 300 SEL

A. Removal and Installation of Upper Padding

Removal:

1. Remove the reveal molding of the windshield (see Job No. 67-2, Section B), and unscrew the loudspeaker grille.

2. Remove the self-tapping screws (1) for the attachment of the padding (Fig. 68-3/1).

3. First lift the padding slightly upward (see arrow in picture) and then pull it down toward the interior of the car.

Installation:

4. Installation is the reverse of the removal procedure.

Fig. 68-3/1

1 Self-tapping screws
2 Clips

B. Removal and Installation of Lower Padding

Removal:

1. Loosen the connections between steering column jacket and instrument panel.

2. Turn out the fixing screws for the padding at the lower side of the instrument panel.

3. Pull the padding out of the garnish molding.

Installation:

4. Installation is the reverse of the removal procedure; make sure that the clips of the padding engage properly in the garnish molding.

Removal and Installation of Left and Right Embellisher on Rear Pillar

Job No.
69-5

Removal:

1. Insert a wire hook in the air outlet on the rear pillar and bend up the fixing plate (2) toward the rear (Fig. 69-5/1).

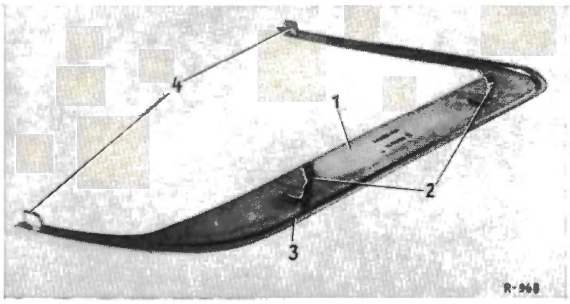


Fig. 69-5/1

1 Embellisher
2 Fixing plate
3 Recess
4 Fixing lug

2. Pull out the embellisher (1) from the fixing slots toward the front and remove.

Installation:

3. Insert a 2 mm diameter Terostat tape in the recess (3) of the embellisher.

4. Insert the fixing lugs (4) of the embellisher in the fixing slots. Push the embellisher toward the rear in the fixing slots, press it against the rear pillar and bend the fixing plate toward the front by means of a screw driver.

Removal and Installation of Reveal Molding at Left or Right Front or Rear Door

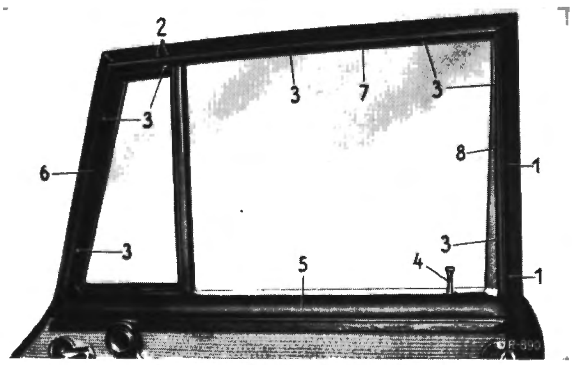
Job No.
72-3

The reveal molding consists of the following parts:

Reveal molding front
Reveal molding top
Reveal molding rear
} Wood (only 220 Sb and 220 SEb)
Reveal molding bottom, clamping part

Removal:

1. Remove the button for the inside safety lock (4) (Fig. 72-3/1).



(Shown at front door)

Fig. 72-3/1

1 Fixing screws for window frame rear garnish molding
2 Fixing screws for ventilator
3 Fixing screws for reveal molding
4 Button for inside safety lock
5 Reveal molding bottom
6 Reveal molding front
7 Reveal molding top
8 Reveal molding rear

2. Lift the lower reveal molding (5) upward by hand, and remove together with the retaining clips (Fig. 72-3/1).

3. Unscrew the fixing screws (3) for the front reveal molding, the top reveal molding (7), and the rear reveal molding (8) and remove the reveal moldings (Fig. 72-3/1).

Installation:

4. Fit and screw on the front (6), top (7), and rear (8) reveal molding.

5. Insert the retaining clips in the lower reveal molding (5) and press the retaining clips into the corresponding holes in the door inner panel.

6. Screw in the button for the inside safety lock.

<table><tr><td>Job No.</td></tr><tr><td>72-4</td></tr></table>

Removal and Installation of Window Regulator Handle at Left or Right Front or Rear Door

Removal:

1. Press the padding (3) of the window regulator handle out from behind and pull it off upward (Fig. 72-4/1).

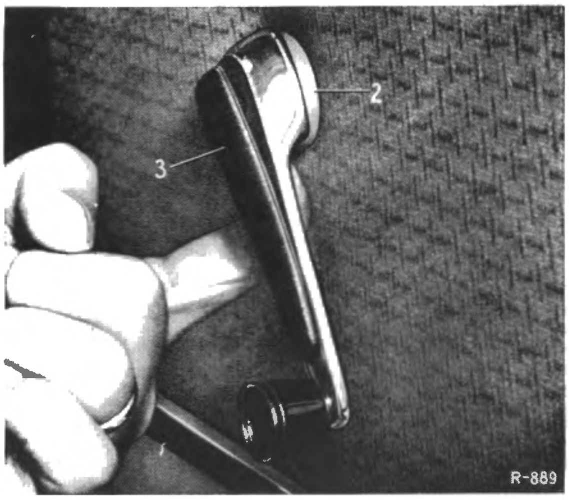


Fig. 72-4/1

2 Spacer
3 Padding

2. Unscrew the fixing screw (1) for the window regulator handle and remove the regulator handle together with the spacer (2) (Fig. 72-4/2).

Installation:

3. Insert the spacer (2) and the regulator handle and tighten by means of the fixing screw (1) (Fig. 72-4/2).

Fig. 72-4/2

1 Fixing screw
2 Spacer
3 Padding

4. Insert the padding (3) as shown in Fig. 72-4/2 by means of the retaining spring in the window regulator handle.

Removal and Installation of Control Knob for Ventilator Lock on Left or Right Front Door

Job No.
72-5

Removal:

1. Insert a wire hook (3) in the bore of the control knob (4) and press off the cap (2) of the control knob (4) toward the front (Fig. 72-5/1).

Note: At the point marked (1) at the rear part of the control knob (4) there is a bore for pressing out the control knob cap (2).

Fig. 72-5/1

1 Marked point
2 Control knob cap
3 Wire hook
4 Control knob

2. Screw out the fixing screw in the center of the control knob and remove the control knob.

Installation:

3. Put the control knob (4) on the pin of the ventilator lock and screw on in the center of the knob by means of the fixing screw.

4. Press in the cap (2) of the control knob (4).

Job No.
72-6

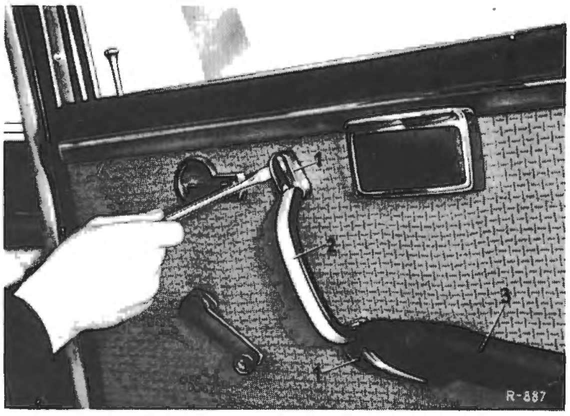
Removal and Installation of Arm Rest and Grip Handle on Left or Right Front or Rear Door

Removal:

1. Unscrew the two fixing screws for the arm rest (3) and remove the arm rest.

2. Remove the control knob for the ventilator lock in the case of the front door (see Job No. 72-5).

3. Carefully lift the two caps (1) for the grip handle (2) by means of a screw driver and push them back (Fig. 72-6/1).



Shown at rear door

Fig. 72-6/1

1 Cap
2 Grip handle
3 Arm rest

4. Unscrew the fixing screws for the grip handle and remove the grip handle.

Installation:

5. Screw on the grip handle (2) and press on the two caps (1) by hand until they click into place.

6. Screw on the arm rest (3).

7. In the case of the front door install the control knob for the ventilator lock (see Job No. 72-5).

Removal and Installation of Door Trim Panel on Left or Right Front or Rear Door

Job No.
72-7

Removal:

1. Remove the window reveal molding (see Job No. 72-3).
2. Remove the window regulator handle (see Job No. 72-4).
3. Remove the control knob for the ventilator lock (see Job No. 72-5; applicable only to the front door).
4. Remove the arm rest and the grip handle (see Job No. 72-6).
5. Use a screw driver to pry off the insert (1) of the recess (2) for the inside door handle of the front or rear door (Fig. 72-7/1).
6. Unscrew the fixing screw in the recess (2) and remove the recess (2) (see Job No. 72-7/1).

Fig. 72-7/1

1 Insert
2 Recess

7. Unscrew the fixing screw (3) for the edge plate (4) and remove the edge plate (4) (Fig. 72-7/2).

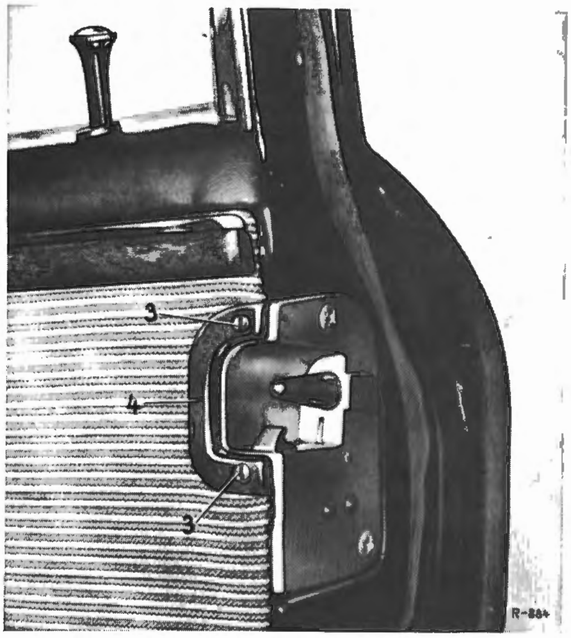


Fig. 72-7/2

3 Fixing screw
4 Edge plate

8. Slide a folding rule or a similar tool from the side under the door trim panel and press out the plastic fasteners which fasten the door trim panel to the door inner panel at the two vertical slides.
9. Slide the door trim panel over the inside door handle and lift it out of the lower retainer.

Installation:

10. Installation is the reverse of the removal procedure.

Job No.
72-8

Removal and Installation of Window Regulator and Sliding Window in Left or Right Front or Rear Door

Modificacion: Fig. 72—8/1

Removal:

1. Remove the door trim panel (see Job No. 72-7).
2. Remove the inner sealing strip (see Job No. 72-10).
3. Wind the sliding window down to its lowest position and remove the two fixing screws (1) for the sliding window from the lower sash channel (2) (Fig. 72-8/1).

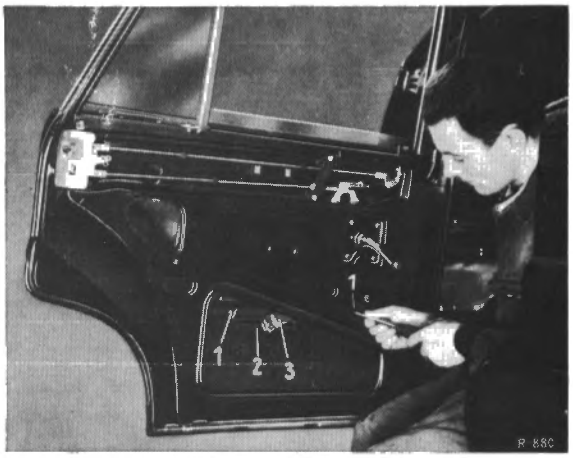


Fig 72-8/1

Shown at rear door

1 Fixing screws
2 Sash channel
3 Window regulator

Fig. 72-8/2

Shown at rear door

1 Fixing screw for window regulator
3 Fixing holes for run channel

4. Slide the door window glass upward by hand and carefully clamp in position by means of a wooden wedge (Fig. 72-8/2).
5. Remove the two fixing screws (3) for the window run channel and push the run channel toward the door outer panel (Fig. 72-8/2).
6. Unscrew the four fixing screws (1) for the window regulator and remove the window regulator together with lower sash channel through the opening in the door inside panel (Fig. 72-8/2).
7. Remove the wooden wedge and carefully slide the window glass downward by hand.

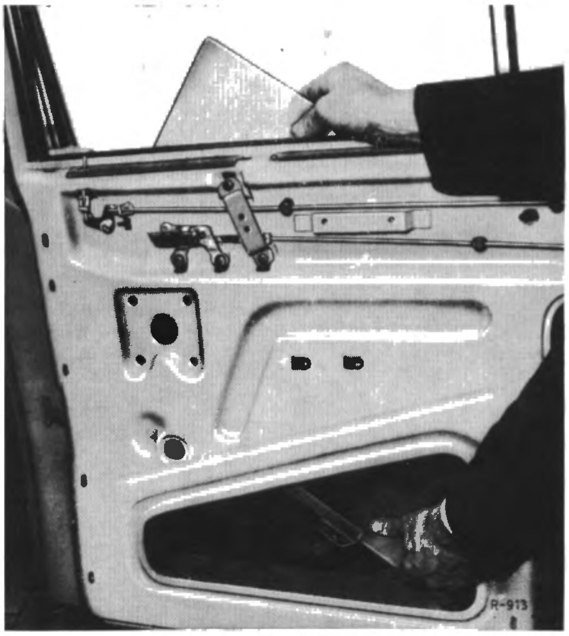


Fig. 72-8/3

Shown at rear door

8. Pull the window run channel slightly toward the hinge side (front door) or toward the lock side (rear door). This frees the sliding window; get a hold on the pane through the opening in the door inner panel, turn it 90° inside the window shaft, and remove upward (Fig. 72-8/3).

Installation:

9. Installation is the reverse of the removal procedure.

Removal and Installation of Garnish Molding at Ledge of Left or Right Front or Rear Door

Job No.
72-9

Removal:

1. Unscrew the nut (1) of the fixing screw at the hinge side and remove together with washer and lock washer (Fig. 72-9/1).

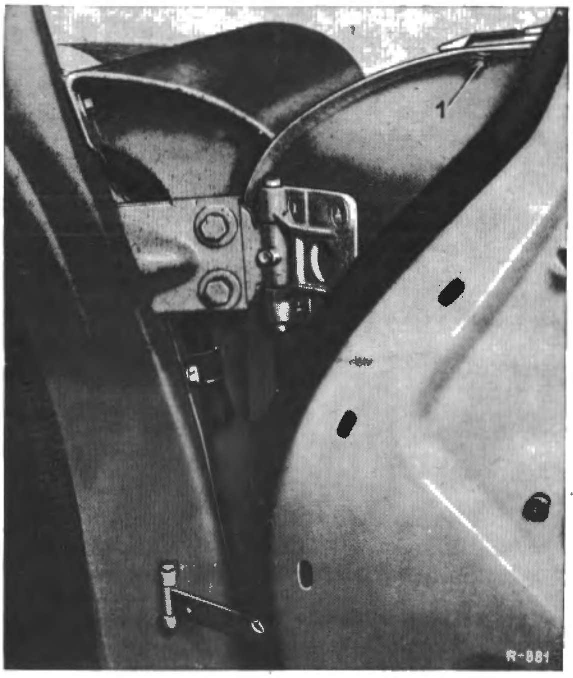


Fig. 72-9/1

1 Nut

2. Slide a folding rule or a similar blunt-edged tool under the hinge-side end of the garnish molding and carefully pull it through under the garnish molding toward the lock side in order to detach the retaining clips.

3. Remove the garnish molding.

Installation:

4. Insert the retaining clips in the retainers on the underside of the garnish molding.

5. Press the garnish molding together with the retaining clips into the holes on the door outer panel.

6. Screw on the garnish molding at the hinge side with nut, washer and lock washer.

Job No.
72-10

Removal and Installation of Outer and Inner Sealing Strip on Front or Rear Door

Modification: new para 2

Removal:

1. Remove door trim panel (see Job No. 72-7).

2. By means of a screwdriver push the retaining clips of the inner sealing strip upward and remove the sealing strip together with the retaining clips upward.

3. Remove the garnish molding at the ledge (see Job No. 72-9).

Fig. 72-10/1

1 Retaining clip
2 Sealing strip

4. The outer sealing strip (2) together with the retaining clips (1) is removed upward in the same way (Fig. 72-10/1).

Installation:

5. Insert the new retaining clips (1) in the door (Fig. 72-10/1).

Note: Usually when the sealing strip is removed, the retaining clips (1) are left on the strip.

It is hardly possible to remove the clips from the sealing strip without damaging either the clips or the strip. It is advisable therefore always to use new retaining clips when installing a new sealing strip. The sealing strip on the front door is fastened by three clips and the strip of the rear door by four clips.

6. Press the sealing strip (2) into the clips from above (see Fig. 72-10/1).

7. Install the garnish molding at the ledge (Job No. 72-9).

8. Install the window regulator and the sliding window.

Removal and Installation of Flexible Window Run Channel on Left or Right Front or Rear Door

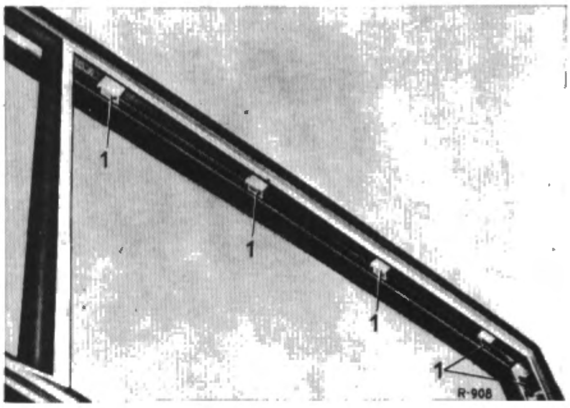
Job No.
72-12

Removal:

1. Remove the sliding window (see Job No. 72-8 or 73-8).

2. Remove the inner and outer sealing strip (see Job No. 72-10).

3. Pry the cemented part of the flexible window run channel (vertical parts) loose and pull it out together with retaining clips (1) in the upper horizontal area (Fig. 72-12/1).



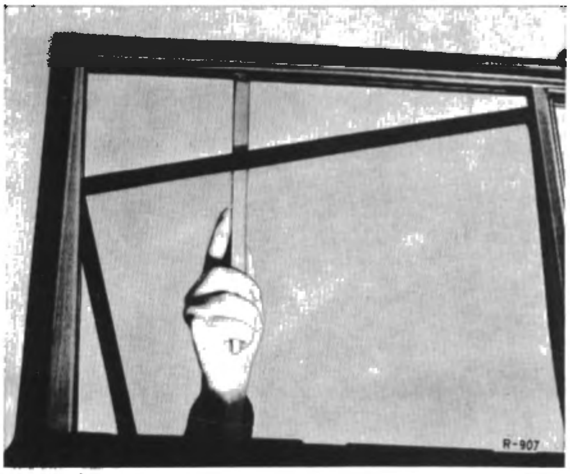
Shown at rear door
Fig. 72-12/1
1 Retaining clip

Note: The retaining clips cannot be removed from the window run channel without damaging either the clips or the channel. When a new window run channel is installed, new retaining clips must therefore be used.

Installation:

4. Put the retaining clips in the door by means of a wooden driver (Fig. 72-12/2).

5. Fit the flexible window run channel, bend it as required and tap it into place by means of a hammer and wooden driver



Shown at rear door

Fig. 72-12/2

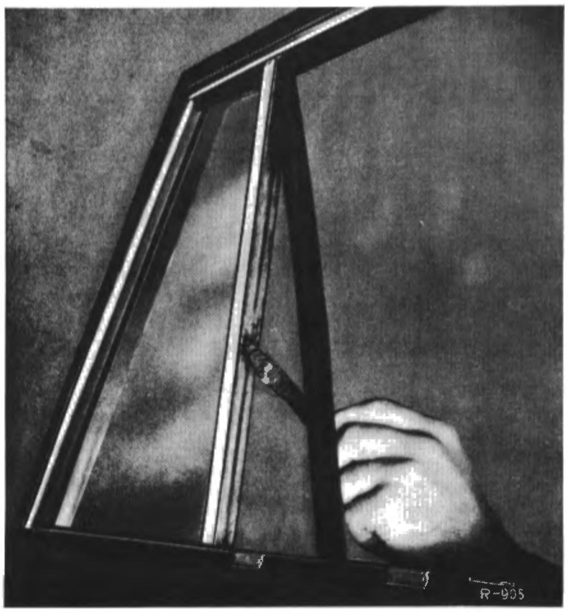
by light taps, starting at the top corner on the hinge side of the door (Fig. 72-12/3).

Shown at rear door

Fig. 72-12/3

6. Use bodywork adhesive to cement the flexible window run channel to the two vertical sides (Fig. 72-12/4) and straighten it, especially in the corners, by means of a wooden driver.

7. Install the outer and inner sealing strips (see Job No. 72-10).



Shown at rear door

Fig. 72-12/4

Shown at rear door

Fig. 72-12/5

1 Slot
2 Window run channel

8. Install the sliding window (see Job No. 72-8 or 73-8).

9. Insert the window run channel (2) and fix it loosely in the slots (1) (Fig. 72-12/5).

10. Cement the flexible window run channel to the screwed-on window run channel.

11. Adjust the screwed-on window run channel in the slotted holes (1) in such a way that the window glass has a side clearance of appr. 2 mm.

12. Check the sliding window for ease of movement by raising and lowering it several times. If necessary, straighten the window run channel by means of a wooden driver.

Ventilator and Ventilator Lock

Job No.
72-13

A. Removal and Installation of Ventilator on Left or Right Front Door

Removal:

1. Remove the window regulator and the sliding window (see Job No. 72-8).
2. Remove the outer and inner sealing strip (Job No. 72-10).
3. Remove the flexible window run channel (see Job No. 72-12).
4. Unscrew the hexagon screw (1) (Fig. 72-13/1).

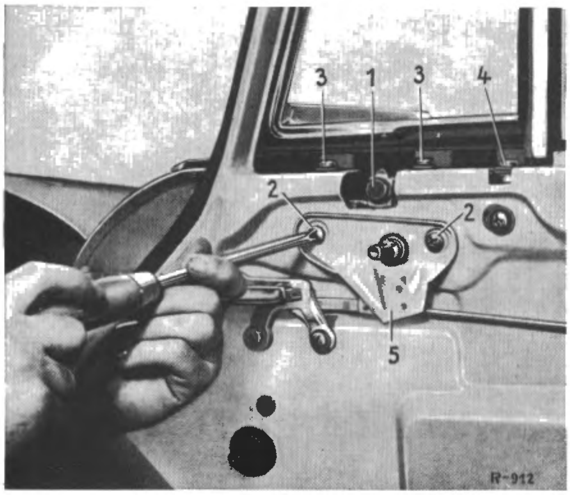


Fig. 72-13/1

1 Hexagon screw
2 Fixing screw
3 Fixing screw
4 Fixing screw
5 Mounting plate

5. Slightly loosen the two fixing screws (2) for the ventilator lock and push the ventilator lock downward in the slotted holes in order to free the lower pivot pin of the ventilator (Fig. 72-13/1).
6. Unscrew the fixing screws (3) and (4).
7. Unscrew the two top fixing screws (2) (see Fig. 72-13/1) and take out the ventilator together with the ventilator frame (Fig. 72-13/2).

Fig. 72-13/2

Installation:

8. Installation is the reverse of the removal procedure (see also Section B, No. 6).

B. Removal and Installation of Ventilator Lock on Left or Right Front Door

Removal:

1. Remove the door trim panel (see Job No. 72-7).
2. Remove the hexagon screw (1) (see Fig. 72-13/1).
3. Unscrew the fixing screws (2) and (3) for the ventilator lock (see Fig. 72-13/1).

4. Take out the mounting plate (5) (see Fig. 72-13/1) for the grip handle and remove the ventilator lock through the opening in the door inner panel (Fig. 72-13/3).

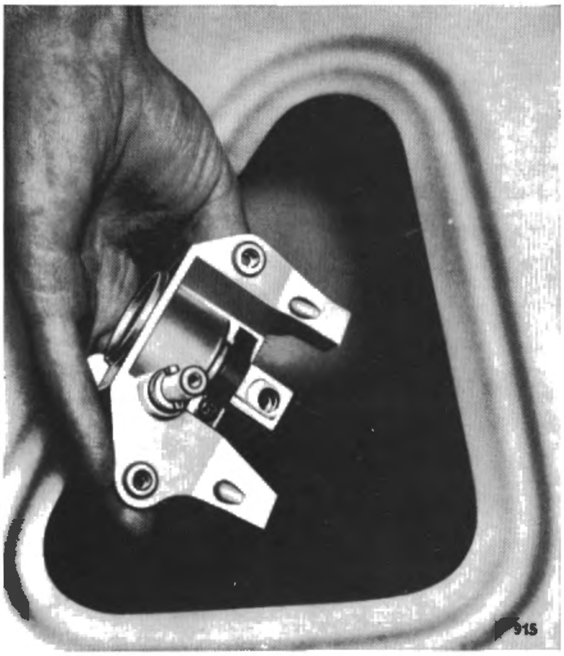


Fig. 72-13/3

Installation:

5. During re-installation do not omit the mounting plate (5) for the grip handle (see Fig. 72-13/1).

6. When re-installing the ventilator lock, put the control knob (1) loosely on the pin and align the lug (2) with the pivot pin eye (3) by turning the knob (Fig. 72-13/4).

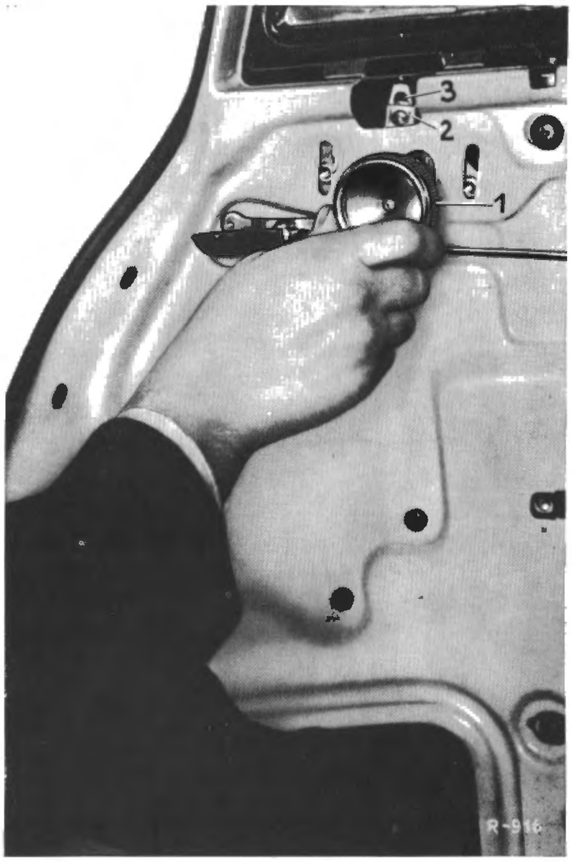


Fig. 72-13/4
1 Control knob
2 Lug
3 Pivot pin eye

Removal and Installation of Garnish Moldings at Window Frame of Left or Right Front or Rear Door

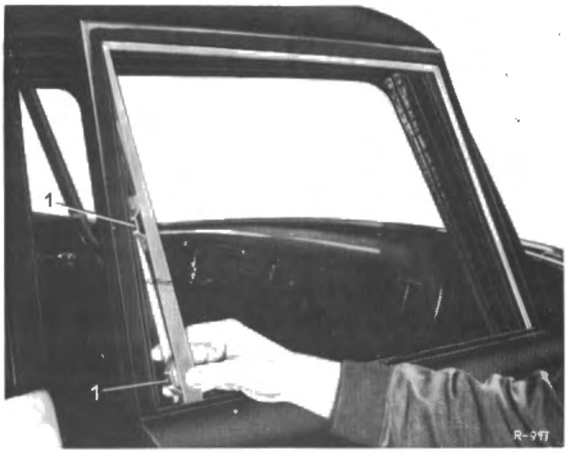
Removal:

1. Remove the window regulator and the sliding window (see Job No. 72-8).

2. Remove the flexible window run channel (see Job No. 72-12).

3. Remove the ventilator (see Job No. 72-13).

4. Unscrew the two fixing screws (1) for the garnish molding at the rear and remove the garnish molding (see Fig. 72-3/1 and 72-15/1).



Shown at front door

Fig. 72-15/1

1 Fixing strap

Shown at front door

Fig. 72-15/2

1 Front garnish molding
2 Upper garnish molding

5. Remove the upper garnish molding (2) (Fig. 72-15/2).

6. Remove the front garnish molding (1) (Fig. 72-15/2).

Installation:

7. Fit the front garnish molding (1) and the upper garnish molding (2) and insert them, making sure that a snug fit is obtained at the corner (Fig. 72-15/2).

8. Put a clip-on nut (2) on each of the two fixing straps (1) of the rear garnish molding (Fig. 72-15/3).

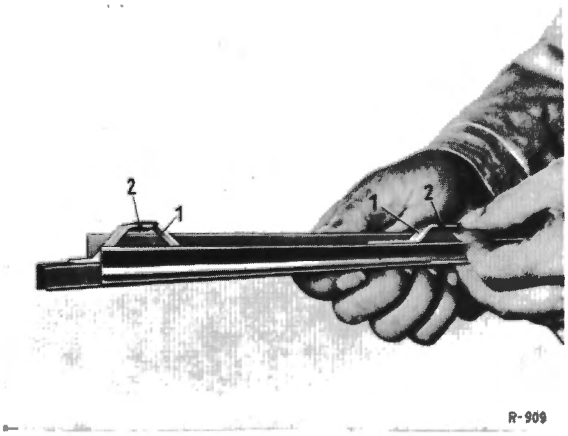


Fig. 72-15/3

1 Fixing strap
2 Clip-on nut

9. Insert the rear garnish molding (Fig. 72-15/1).

10. Screw on the rear garnish molding by means of the two fixing screws (1) (see Fig. 72-3/1).

11. Install the ventilator (see Job No. 72-13).

12. Install the flexible window run channel (see Job No. 72-12).

13. Install the window regulator and the sliding window (see Job No. 72-8).

Job No.
72-16

Removal and Installation of Weatherstrip for Front or Rear Door

The weatherstrip (2) is held in place by the sheet metal section of the door groove (Fig. 72-16/2). At the hinge side outside the groove the weatherstrip is cemented by Terokal Rubber Adhesive I and fixed by means of spreader clamps.

Removal:

1. Carefully detach the weatherstrip (2) where it is cemented and lift the plastic spreader clamps (1) out of the fixing holes in the door inner panel (3) (Fig. 72-16/1). Carefully scrape off all rubber and adhesive residues.

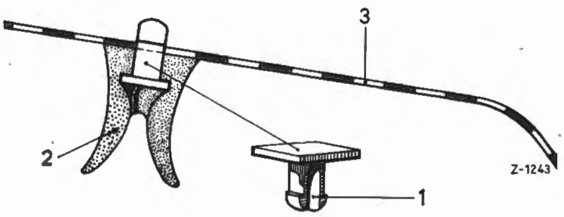


Fig. 72-16/1

1 Plastic spreader clamp
2 Weatherstrip
3 Door inner panel

2. Pull out the rest of the weatherstrip from the retaining section and remove it (Fig. 72-16/2).

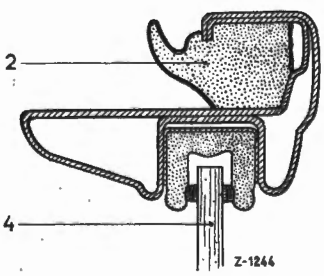


Fig. 72-16/2

2 Weatherstrip
4 Window glass

Installation:

3. Press the weatherstrip (2) into the retaining section of the door (Fig. 72-16/2).

4. Insert the plastic spreader clamps (1) in the weatherstrip.

Note: For the front door 6 spreader clamps (1) are needed and for the rear door 4 spreader clamps (Fig. 72-16/1).

5. Coat the door inner panel in the area of the weatherstrip with Terokal Rubber Adhesive II and press the spreader clamps (1) into the holes in the door inner panel (Fig. 72-16/1).

Note: The weatherstrip is applied by means of a so-called two-component adhesive. The weatherstrip supplied as a replacement part has been treated with Terokal Rubber Adhesive I. The vulcanizing effect which produces a firm bond between rubber and sheet metal is brought about when the two components come into contact.

Door Lock and Actuating Mechanism

Job No.
72-17

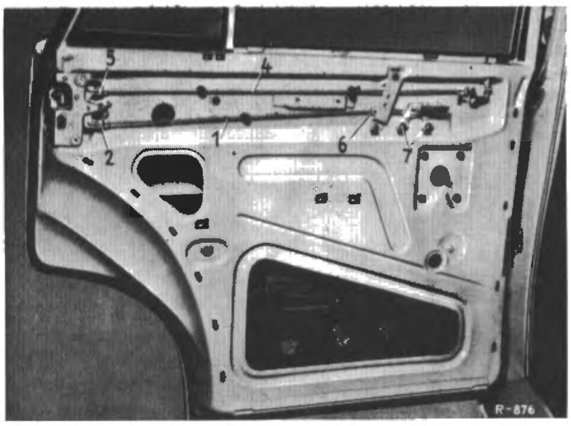
A. Removal and Installation of Front or Rear Inner Door Handle

Removal:

1. Remove the door trim panel (see Job No. 72-7).
2. Use a screw driver to press out the locking spring (6) and detach the pull rod (1) (Fig. 72-17/1).
3. Unscrew the two fixing screws (7) and remove the inner door handle (Fig. 72-17/1).

Installation:

4. Installation is the reverse of the removal procedure. Please remember that before the fixing screws (7) are tightened the inner door handle must be pushed toward the hinge side to give it initial tension.



Shown at rear door

Fig. 72-17/1

1 Pull rod
2 Locking spring
4 Pull rod for inside safety lock
5 Locking spring
6 Locking spring
7 Fixing screw

B. Removal and Installation of Front or Rear Door Handle

Removal:

1. Remove the door trim panel (see Job No. 72-7).
2. Back out the fixing screw (1) about two turns. Unscrew the fixing screw (2) (Fig. 72-17/2).
3. Push the door handle toward the hinge side and remove together with the rubber pads (Fig. 72-17/3).

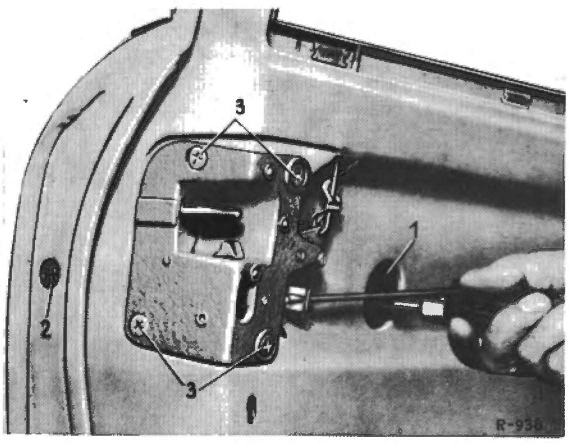


Fig. 72-17/2

1 Fixing screw for door handle
2 Fixing screw for door handle
3 Fixing screw for door lock

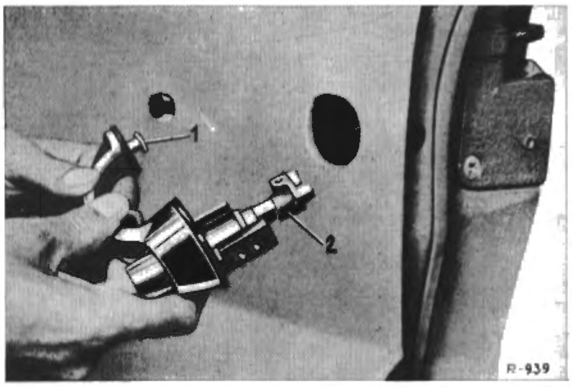


Fig. 72-17/3

1 Fixing screw
2 Pressure bolt base

Installation:

4. Apply talc to the two rubber pads and insert the door handle together with the rubber pads.

5. Apply slight pressure to the door handle and check the clearance between pressure bolt base and pressure pin of the door lock, and if necessary adjust the clearance to 1–2 mm by adjusting the pressure bolt base (see Fig. 72-17/3).

6. Screw in the fixing screw (2) together with a large washer and tighten well. Then tighten the fixing screw (1) (see Fig. 72-17/2).

C. Removal and Installation of Front or Rear Door Lock

Removal:

1. Remove the door trim panel (see Job No. 72-7).

2. Detach the locking spring (2) by means of a screw driver and detach the pull rod (1) (Fig. 72-17/4).

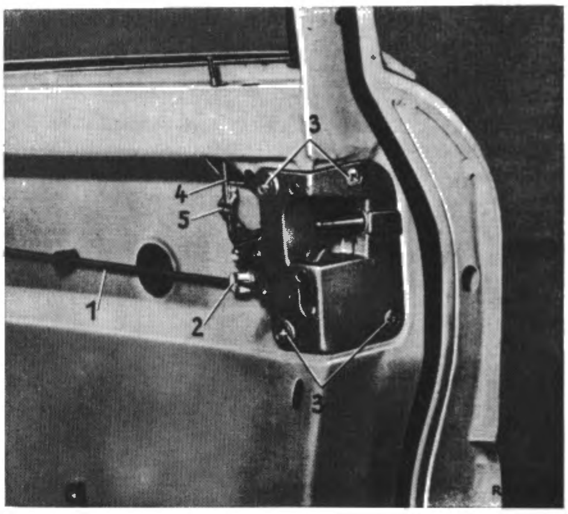
Note: On the rear door an additional job 2a is necessary:

2a. Detach the locking spring (5) by means of a screw driver and detach the pull rod (4) for the inside safety lock (see Fig. 72-17/1).

3. Unscrew the four fixing screws (3) and remove the lock (Fig. 72-17/4).

Installation:

4. Installation is the reverse of the removal procedure. Please note that the two fixing screws (3) at the front end of the door must be tightened first.



Shown at front door

Fig. 72-17/4

1 Pull rod
2 Locking spring
3 Fixing screw
4 Pull rod
5 Locking spring

D. Removal and Installation of Striker on Left or Right Front or Rear Door

Removal:

1. Unscrew the fixing screws and remove the striker together with shim.

Installation:

2. Screw the striker into place and lightly tighten the screws. Close the door so that the striker can adjust itself with relation to the door lock. If necessary correct the position of the striker by adding shims.

Note: Shims are available in three different thicknesses:

Part No.	10 120 723 02 05	0.5 mm thick
Part No.	10 120 723 03 05	1.0 mm thick
Part No.	10 120 723 04 05	1.5 mm thick

3. With the door closed, shift the position of the striker by pressing in or pulling out the door in such a way that the outer panels of the two doors are flush with the outer panels of the fenders. Then open the door and tighten the fixing screws for the striker.

Job No.
73-13

Removal and Installation of Fixed Window on Left or Right Rear Door

Removal:

1. Remove the door trim panel (see Job No. 72-7).
2. Remove the sliding window (see Job No. 73-8).
3. Remove the inner and outer sealing strip (see Job No. 72-10).
4. Remove the flexible window run channel (see Job No. 72-12).
5. Unscrew the two fixing screws (1) at the stop bracket (5) and remove the stop bracket (5) (Fig. 73-13/1).

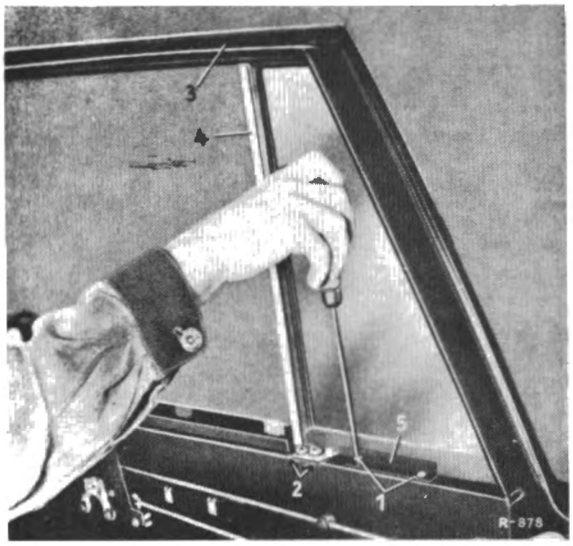


Fig. 73-13/1

1 Fixing screw
2 Fixing screw
3 Fixing screw
4 Window stay bar
5 Stop bracket

6. Unscrew the fixing screw (3) at the top of the stay bar (Fig. 73-13/1).
7. Unscrew the two fixing screws (2) at the mounting plate at the bottom of the stay bar (see Fig. 73-13/1).
8. Remove the stay bar (4) as shown in Fig. 73-13/2.

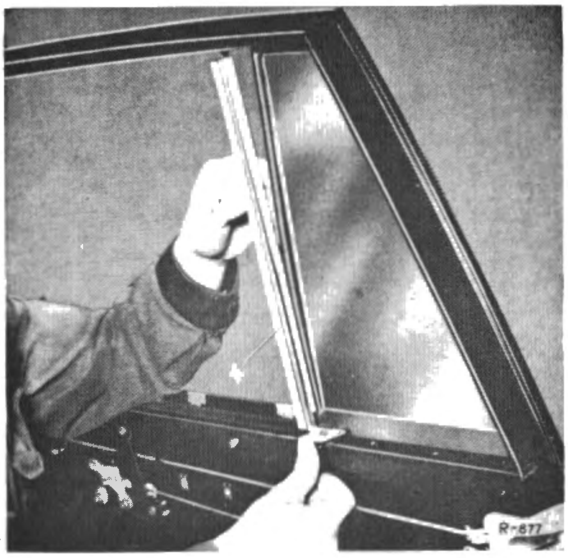


Fig. 73-13/2

4 Stay bar

9. Remove the glass (6) together with the rubber molding (7) toward the front (Fig. 73-13/3).

Fig. 73-13/3

6 Window glass
7 Rubber molding

Installation:

10. Installation is essentially the reverse of the removal procedure.

Removal and Installation of Rear Compartment Lid

Job No.
75-1

Removal:

1. Remove the cottered pin (1) from the torsion bar (3) (Fig. 75-1/1). Then release the torsion bar by means of Removal Tool 111 589 02 61 (see Fig. 00-1/1).

Fig. 75-1/1

1 Cottered pin
2 Fixing screw
3 Torsion bar
4 Rear compartment lid
5 Rear lid hinge.
6 Slotted hole

2. Unscrew the fixing screws (2) at the left and the right of the rear lid hinge (5). Remove the rear compartment lid (4) together with the torsion bar (3) (see Fig. 75-1/1).

Note: If necessary, remove the chrome figures of the model number, the Mercedes star, and the rubber buffers.

Installation:

3. First lightly attach the rear compartment lid to the hinge brackets and close the lid. Move the lid back and forth in the slotted holes of the hinges (6) in order to produce uniform clearance between the rear compartment lid and the adjoining body parts.

4. Adjust the rubber buffers cushioning the rear compartment lid by adding shims or by shortening the buffers until the lid has its proper outside fit.

Job No. 75-4

Removal and Installation of Rear Compartment Lid Weatherstrip

Removal:

1. Remove the cemented weatherstrip and carefully scrape off the remains of the rubber and the adhesive.

Installation:

2. Coat the groove around the rear compartment opening with Terokal Rubber Adhesive II and press the weatherstrip into the groove while it is still wet.

Note: The weatherstrip is cemented into the groove by means of a so-called two-component adhesive. The weatherstrip supplied as a replacement part has already been treated with Terokal Rubber Adhesive I.

The vulcanizing effect which produces a firm bond between rubber and sheet metal is brought about when the two components come into contact.

Steel Sliding Roof

Job No.
78-1

A. Removal and Installation of Sliding Roof

1. Unscrew the left and right sliding rail (1).

2. Unscrew the locking lever and the recess insert.

3. Lift the headlining frame out of the clamps (2) along the front edge (Fig. 78-1/1).

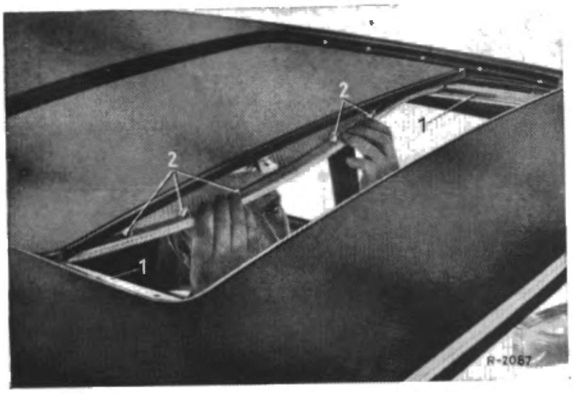


Fig. 78-1/1

1 Sliding rail 2 Clamps

4. Push the sliding roof back as far as it will go and remove the headlining (3) toward the front (Fig. 78-1/2).

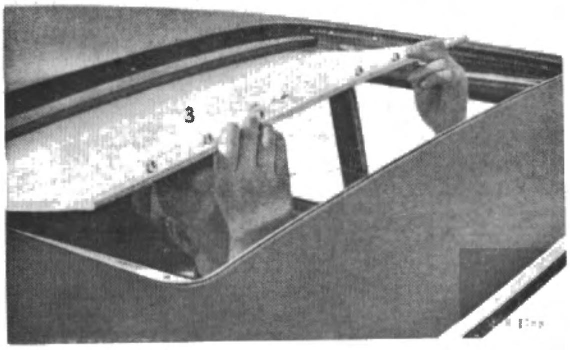


Fig. 78-1/2

3 Headlining

5. Push the sliding roof forward and remove.

6. Installation is the reverse of the removal procedure.

Before the operations are carried out which are described below it is almost always necessary to remove the sliding roof beforehand.

B. Remedies for Binding Locking Lever (Handle)

1. **Cause:**

   Frame too narrow in the region above the stop wedge.

   Remedy:

   Recent cars have been provided with a local dent 1.2 mm deep in this particular region. On older cars this dent should be made subsequently as shown in Fig. 78-1/3. Apply the piece of hard wood as nearly horizontally as possible. Do not make the dent deeper than 1.2 mm (see also Fig. 78-1/5).

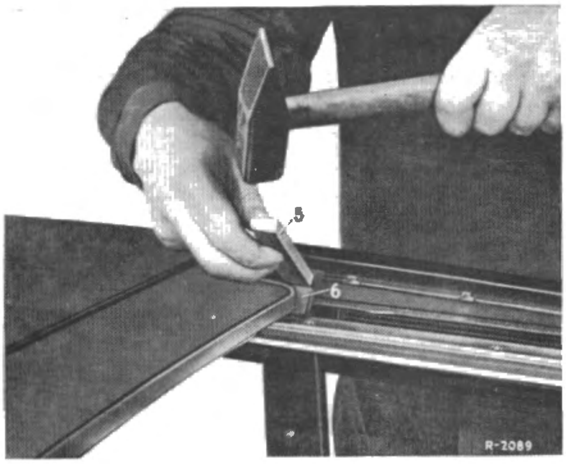


Fig. 78-1/3

5 Piece of hard wood 6 Stop wedge

2. **Cause:**

Brake rods (8) binding in the end supports.

Remedy:

Put shims under the clamps (7) (Fig. 78-1/4).

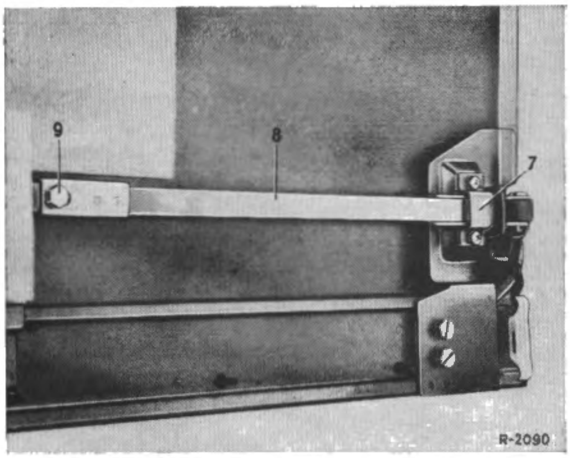


Fig. 78-1/4

7 Clamp
8 Brake rod
9 Locking screw for longitudinal adjustment

3. **Cause:**

Linkage not greased.

Remedy:

Grease the linkage at the contact points and at the joints.

4. **Cause:**

Brake rods (8) adjusted too wide toward the outside.

Remedy:
Loosen the locking screws (9), install the sliding roof, and with the roof partly opened adjust the brake linkage in such a way that efficient braking action is obtained when the roof is locked (Fig. 78-1/4).

Then check the height of the closed roof (alignment with roof top) and correct any differences in height by adjusting the stop wedge (6) by means of the adjusting screw (Fig. 78-1/5).

5. **Cause:**

The lateral plastic wedges (10) which press the sliding roof forward when it is closed are situated too far forward (Fig. 78-1/5).

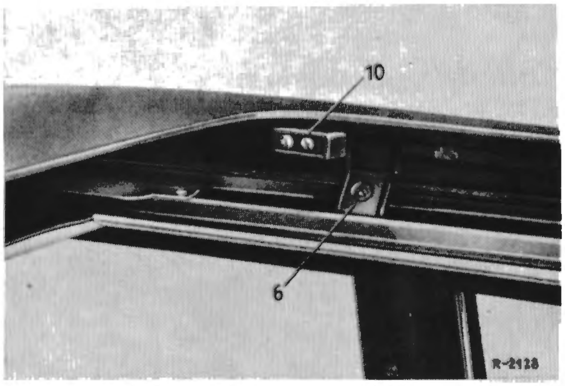


Fig. 78-1/5

6 Stop wedge
10 Plastic wedge

Remedy:

Slightly move the plastic wedges backward, if necessary refile the slotted holes in the plastic wedges (Fig. 78-1/6).

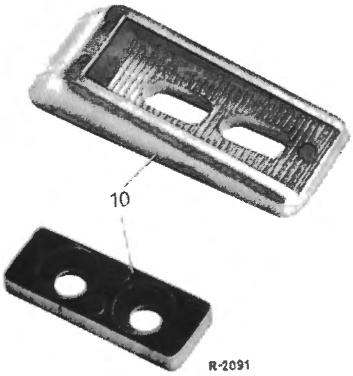


Fig. 78-1/6

10 Plastic wedge

C. Remedies for Binding Sliding Roof

1. **Cause:**

Excessive curvature at the sides of the headlining frame.

Remedy:

Adjust the curvature to the proper dimension: the height "a" as indicated by the two arrows should be 40—60 mm (Fig. 78-1/7).

2. **Cause:**

Insufficient lateral curvature of the headlining frame at the rear.

Remedy:

Adjust the curvature to the proper dimension: the height "b" as indicated by the two arrows should be 10—15 mm (Fig. 78-1/7).

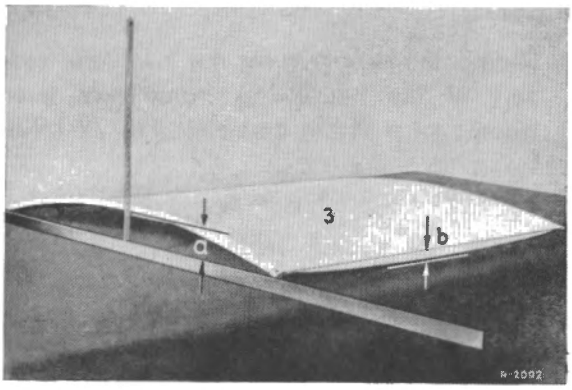


Fig. 78-1/7

3 Headlining

3. **Cause:**

Lateral sliding tapes (linen adhesive tape) sweat and become sticky.

Remedy:

Recent cars have been provided with stainless steel rails replacing the sliding tapes. On other cars the sliding tapes should be replaced by steel rails. The steel rails are inserted in the front cover rail (12) with their hook-shaped front end (Fig. 78-1/8).

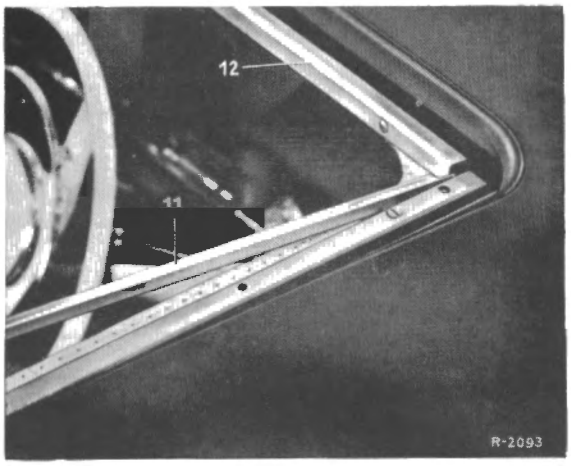


Fig. 78-1/8

11 Steel rail   12 Cover rail

4. **Cause:**

On older cars the headlining (15) is glued to the center cross strut (13) of the sliding roof frame and partly covered with linen adhesive tape (14) (see situation A in Fig. 78-1/9). The linen adhesive tape (14) sweats and becomes sticky or partly detached. On recent cars the headlining (15) is no longer glued to the frame, but is laid in the modified frame profile of the cross strut (13) with a strip of cardboard (16) (see situation C in Fig. 78-1/9).

Remedy:

Remove the adhesive tape and detach the glued headlining from the frame and cut it in such a way that it only goes as far as the trough of the corrugation (17). Re-attach the headlining (see situation B in Fig. 78-1/9).

These measures serve to keep the contact pressure in this region at a minimum.

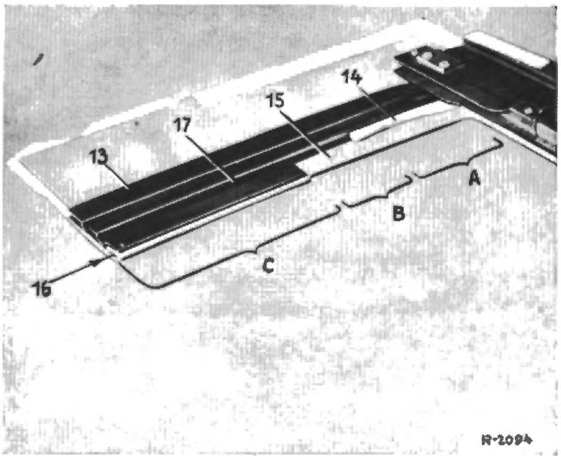


Fig. 78-1/9

shown at a model

13 Cross strut
14 Linen adhesive tape
15 Headlining
16 Cardboard strip
17 Corrugation

5. **Cause:**

Adjustment of sliding angles (18) and (19) of the sliding roof too narrow.

Remedy:

Release angle adjustment. The rear sliding angles (19) can be given more lateral play than the front angles since at this point the roof is always under lateral stress produced by the brake rods (Fig. 78-1/10).

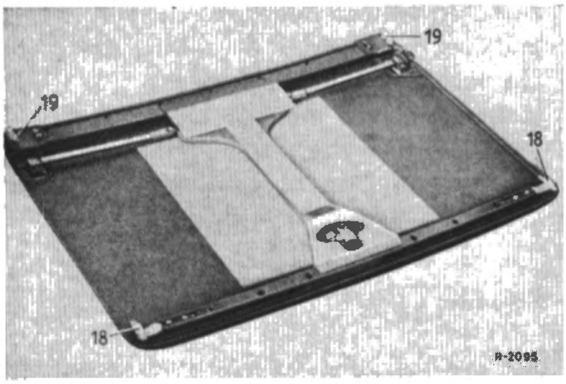


Fig. 78-1/10

18 Front sliding angle 19 Rear sliding angle

6. **Cause:**

Sliding angles (18) and (19) and as a result the plastic sliding jaws are misaligned in the rails.

Remedy:

Take the sliding jaws off the sliding angles and re-align the angles in both directions by means of a ruler (21) (Figs. 78-1/11 and 12).

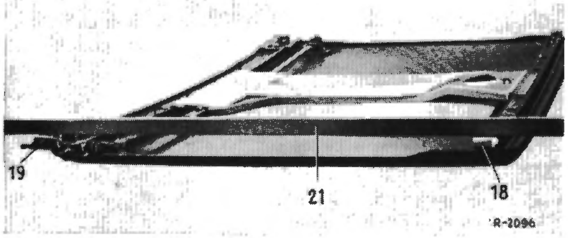


Fig. 78-1/11

18 Front sliding angle 21 Ruler
19 Rear sliding angle

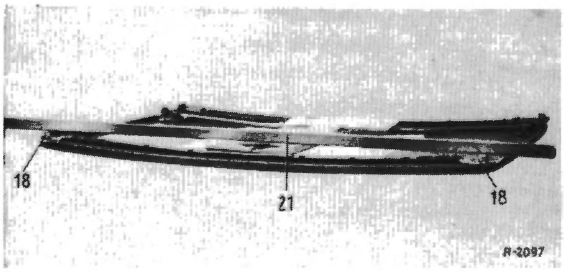


Fig. 78-1/12

18 Front sliding angle 21 Ruler
19 Rear sliding angle

7. **Cause:**

Slide rails and sliding jaws dirty.

Remedy:

Clean the sliding rails. Replace the sliding jaws. Remove all traces of adhesive on the sliding surfaces.

8. **Cause:**

Sliding leathers (22) on the two rear corners of the headlining frame turn over when roof is slid in and bind (Fig. 78-1/13).

Remedy:

Check the sliding leathers, cut down if necessary or install new sliding leathers.

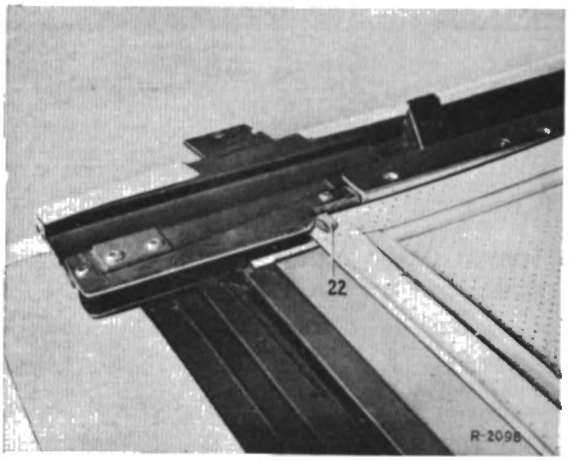


Fig. 78-1/13

22 Sliding leather Shown at a model

9. **Cause:**

The headlining is attached in several layers and therefore too thick in the front corner at the end of the sliding surface for the headlinig frame.

Remedy:

Remove the sliding rail and re-adjust the front part of the sliding surface downward (Fig. 78-1/14).

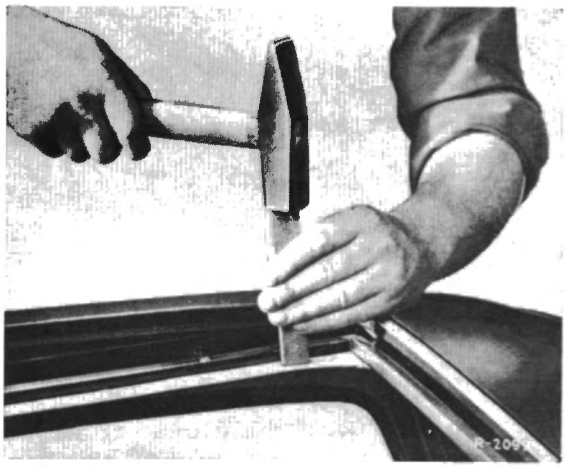


Fig. 78-1/14

Removal and Installation of Side Windows of Coupé Roof

Job No.
79-10

Model 230 SL

Removal:

1. Place the coupé roof on a clean support (felt or similar material) with the top facing downward.

2. Use a drift to knock out the pin (Fig. 79-10/1).

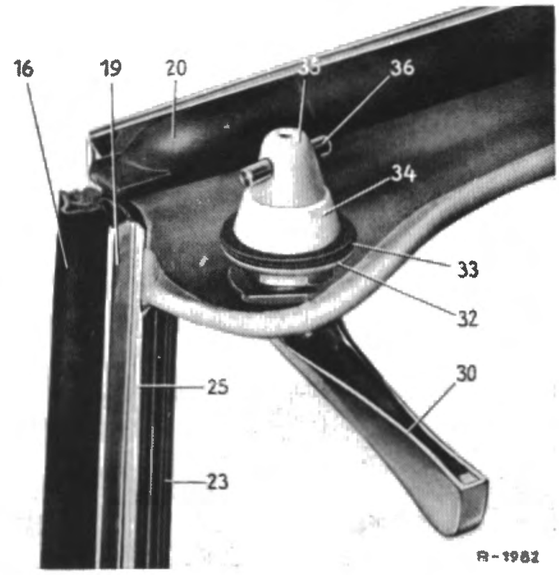


Fig. 79-10/1

16 Weatherstrip
19 Sealing rail
20 Lower sealing
23 Window reveal molding
25 Interior ornamental molding
30 Locking handle
32 Washer
33 Washer
34 Spacer ring
35 Protective cap
36 Pin

3. Remove protective cap (35), spacer ring (34) and washers (33) and (32) upward and remove the locking handle (30) downward (Figs. 79-10/1 and 2).

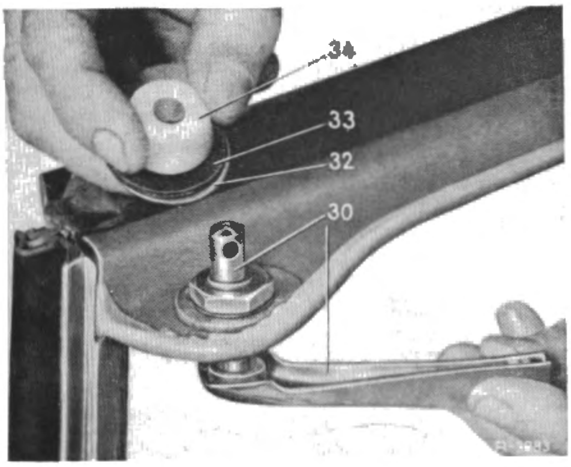


Fig. 79-10/2

30 Locking handle
32 Washer
33 Washer
34 Spacer ring

4. Pull the weatherstrip (16) out of the sealing rail (19) as far as the corner. Then unscrew and remove the sealing rail (19) (Fig. 79-10/3).

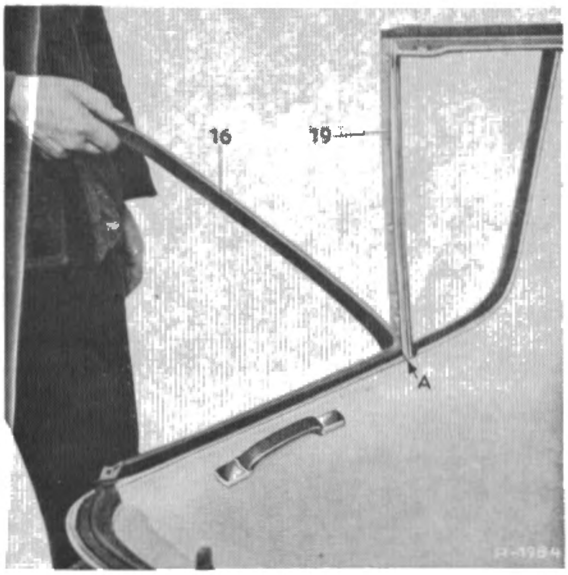


Fig. 79-10/3

16 Weatherstrip
19 Sealing rail

5. Unscrew the interior ornamental molding (25) and remove (Fig. 79-10/4).

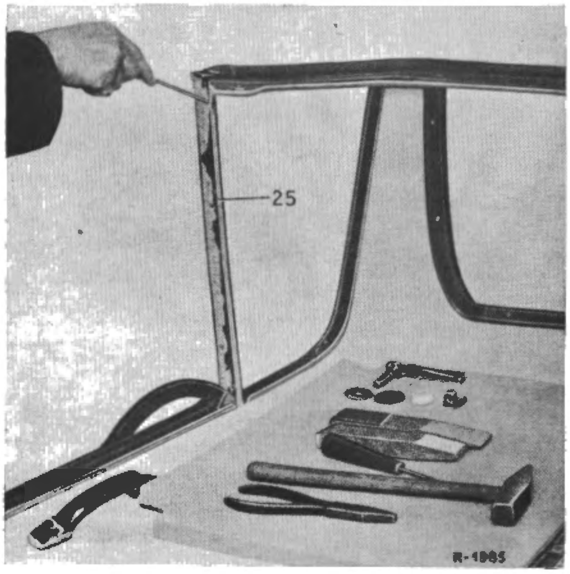


Fig. 79-10/4

25 Interior ornamental molding

6. Remove the window reveal molding (22) and (23) (Fig. 79-10/5).

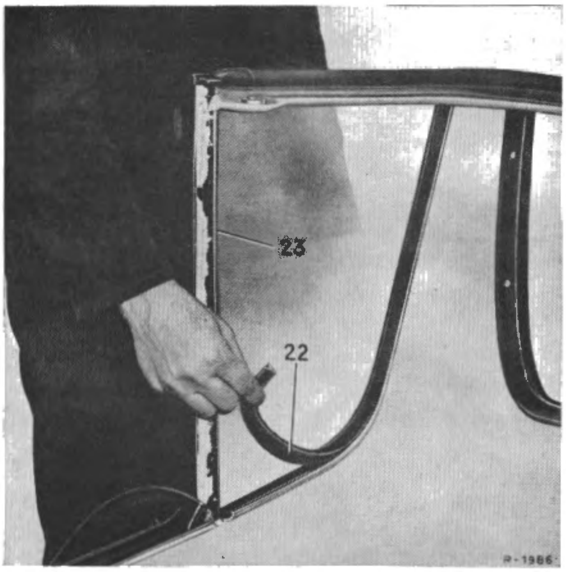


Fig. 79-10/5

22 Window reveal molding
23 Window reveal molding

7. Carefully lift the window glass (9) together with the rubber molding (8) over the ledge of the seal'ng rail (18) by means of a wooden or plastic wedge. Start at the point marked B (Fig. 79-10/6).

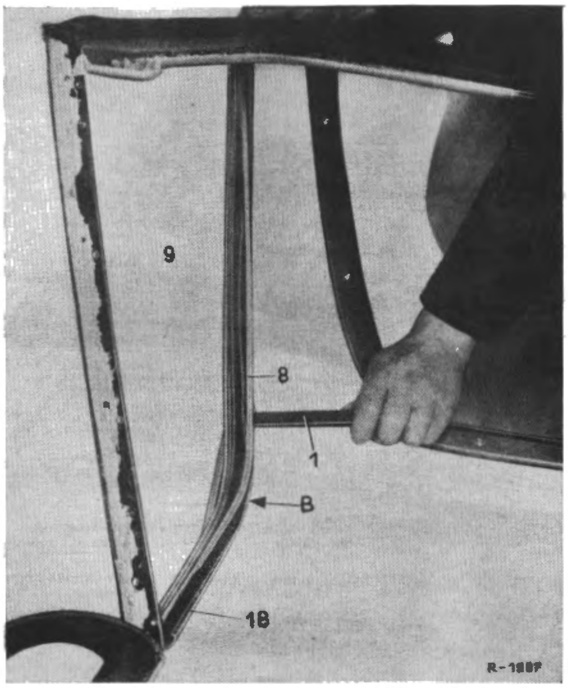


Fig. 79-10/6

1 Plastic wedge
8 Rubber molding
9 Window glass
18 Sealing rail

8. Remove the window glass (9) together with the rubber molding (8) downward (Figs. 79-10/7 and 8).

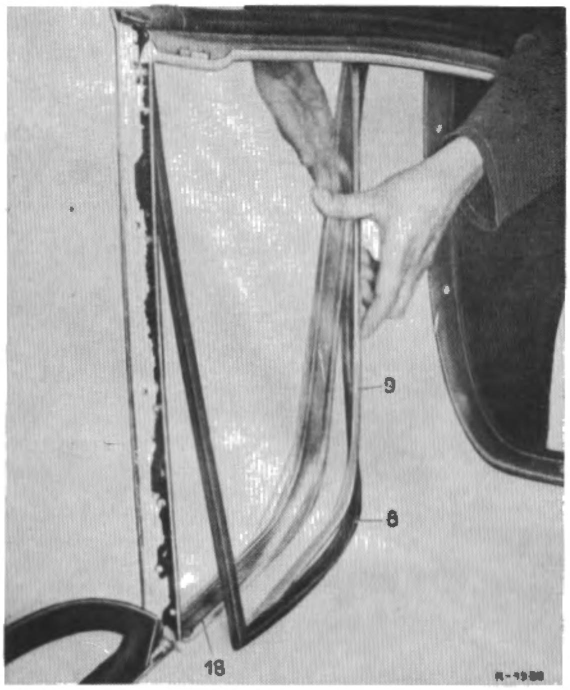


Fig. 79-10/7

8 Rubber molding
9 Window glass
18 Sealing rail

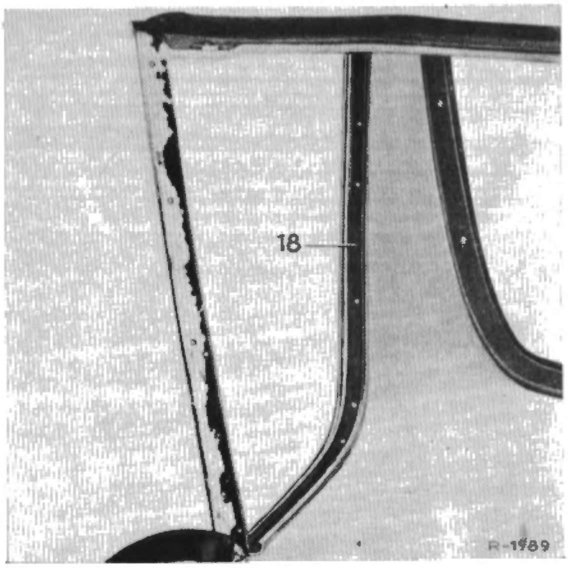


Fig. 79-10/8

18 Sealing rail

Installation:

9. Install the rubber molding (8) on the window glass (9) and apply a little adhesive to facilitate installation.

10. Install the window glass (9) together with the rubber molding (8) from below, push it upward as far as it will go, and lift it over the ledge of the sealing rail (18) by means of a flat wooden or plastic wedge applied at the point marked B (Figs. 79-10/8, 7 and 6).

11. If the rubber molding (8) should have been displaced during the operation move it into its proper position. Push the window glass toward the outside as far as it will go and install the window reveal moldings (22) and (23) (Fig. 79-10/5).

12. Screw on the interior ornamental molding (25) (Fig. 79-10/4).

13. Screw on the sealing rail (19). Coat the weatherstrip (16) with Dekalin adhesive at the corner A and press it into the sealing rail (19). Use Dekalin adhesive also to stick down the end of the weatherstrip (16) (Fig. 79-10/3).

14. Insert the locking handle (30). Install the washers (32) and (33), the spacer ring (34), and the protective cap (35), and fix into position by means of the pin (36) (Figs. 79-10/2 and 1).

Heating and Ventilation – Group 83

Heating and Ventillation

Job No.
83-1

A. Removal and Installation of Connecting Duct for Rear Compartment Heating

Removal:

1. Remove the left and right cover panels below the instrument panel (see Job No. 68-3).

2. Remove the left and right rubber mats from the front floor and the rubber mats from the front part of the transmission tunnel.

3. Screw out the oval head tapping screws (1) and the hexagon screws (2) on the connecting duct (3) (Fig. 83-1/1).

4. Remove the connecting duct (3) together with the seals (4) from the left defroster nozzle (8) and the right defroster nozzle (9) (Fig. 83-1/1).

Installation:

5. Installation is the reverse of the removal procedure. Care should be taken to ensure that the rubber seals on the defroster nozzles fit snugly against the connecting duct (3).

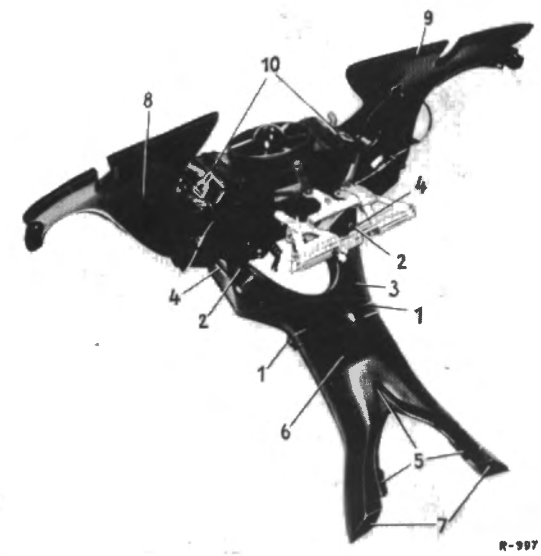


Fig. 83-1/1

1 Oval head tapping screw	6 Heating duct
2 Hexagon screw	7 Seal
3 Connecting duct	8 Left defroster nozzle
4 Seal	9 Right defroster nozzle
5 Oval head tapping screw	10 Clips

B. Removal and Installation of Heating Duct for Rear Compartment Heating

Removal:

1. Remove the connecting duct for the rear compartment heating (see Section A).

2. Unscrew the oval head tapping screws (5) on the heating duct (6) for the rear compartment heating (see Fig. 83-1/1).

3. Pull the heating duct (6) together with the seals (7) out of the cross member and remove it (see Fig. 83-1/1).

Installation:

4. Installation is the reverse of the removal procedure.

C. Removal and Installation of Right Defroster Nozzle

Removal:

1. Remove the connecting duct for the rear compartment heating (see Section A).

2. Open the clips (10) (see Fig. 83-1/2).

3. Remove the locking washer (23) on the air flap lever (24). Pull the wire cable (25) and the wire cable (26) off the air flap lever (24) (see Fig. 83-1/2).

4. Detach the wire cable sheaths (27) at the fixing clips (see Fig. 83-1/2).

5. Detach the short link from the motor crank of the windshield wiper motor (see Job No. 82-4, para 2).

6. Remove the defroster nozzle (9) downward (see Fig. 83-1/2).

Installation:

7. Installation is the reverse of the removal procedure.

Note: For attachment and adjustment of the defroster nozzle wire cables see Section F.

D. Removal and Installation of Heater Box with Heat Exchanger and Blower

Removal:

1. Remove the right defroster nozzle (see Section C).

2. Open the clips (10) on the left defroster nozzle (8).

Note: It is not necessary to remove the left defroster nozzle.

Fig. 83-1/2

View from below

8 Left defroster nozzle
9 Right defroster nozzle
10 Cover
11 Wire cable for regulating valve
12 Left regulating valve
13 Right regulating valve
14 Wire cable for fresh-air flap
15 Fixing screw
16 Fixing screw
17 Heater box
23 Locking washer
24 Air flap lever
25 Wire cable
26 Wire cable
27 Wire cable sheath
28 Air flap lever
29 Control lever
30 Fixing screw
31 Fixing nut
32 Escutcheon

3. Detach the wire cables (11) at the regulating valves (12 and 13) (Fig. 83-1/2).

4. Detach the wire cable (14) for the fresh-air flap (see Fig. 83-1/2).

5. Use a socket wrench to unscrew the two fixing screws (15) on the cowl and the fixing screw (16) on the water tank (see Fig. 83-1/2).

Note: Push the left defroster nozzle (8) toward the left to be able to get at the left fixing screw (15) on the cowl.

6. Pull the blower motor connector out of the heater box.

7. Drain the cooling water (collect it if it contains additives). The drain cocks are located under the radiator to the right and on the crankcase to the left.

8. Detach the water hoses (18) from the return pipe (19) (see Fig. 83-1/3).

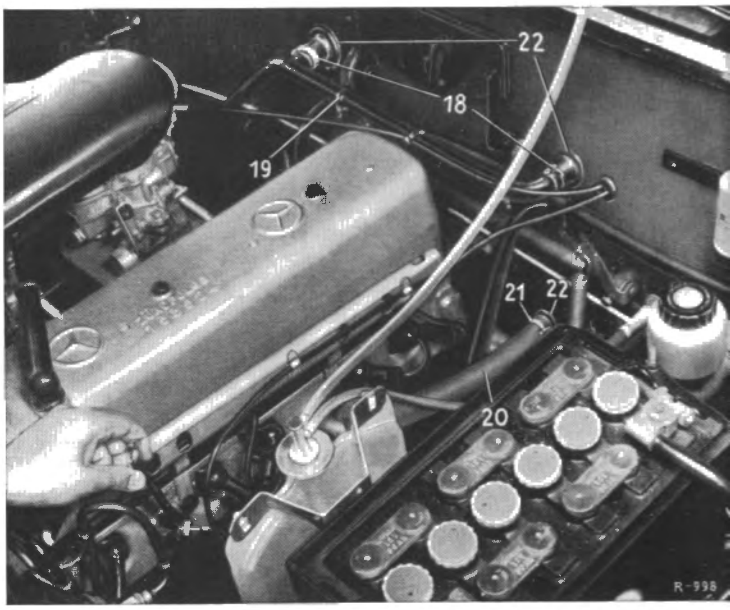


Fig. 83-1/3

18 Water hose on return pipe
19 Return pipe
20 Water hose on feed pipe
21 Feed pipe
22 Rubber grommet

9. Detach the water hose (20) from the feed pipe (21) (see Fig. 83-1/3).

10. Remove the rubber grommets (22) from the cowl (see Fig. 83-1/3).

11. Remove the heater box (17) with the heat exchangers and the blower toward the rear (see Fig. 83-1/2).

Installation:

12. Installation is the reverse of the removal procedure.

Note: For attaching and adjusting the wire cable for the fresh-air flap and for the regulating valves see Section F.

E. Removal and Installation of Left Defroster Nozzle

Removal:

1. Remove the right defroster nozzle (see Section C).

2. Remove the heater box with heat exchanger and blower (see Section D).

3. Unscrew the control knob and the escutcheon of the choke control. Pull the choke control out of the instrument panel toward the front and push it into the engine compartment.

4. Detach the wire cable (25) from the air flap lever (28) and the wire cable sheath (27) from the fixing clip (see Fig. 83-1/2).

5. Remove the defroster nozzle (8) downward (see Fig. 83-1/2).

Installation:

6. Installation is the reverse of the removal procedure.

Note: For attaching and adjusting the wire cable for the defroster nozzle see Section F.

F. Removal and Installation of Operating Assembly for Heat Exchanger, Defroster, Nozzles and Fresh-Air Flap

Removal:

1. Remove the left and right panels underneath the instrument panel.

2. Use a screwdriver to pull out the control levers (29) for the wire cables of the regulating valves, the defroster nozzles and the fresh-air flap.

3. Loosen the fixing screws (30) of the wire cables and wire cable sheaths on the operating assembly. Pull out the wire cables together with the sheaths (see Fig. 83-1/2).

4. Remove the blower switch.

5. Unscrew the two fixing nuts (31) for the escutcheon (32). Remove the escutcheon (32) toward the rear and remove the operating assembly toward the front (see Fig. 83-1/2).

Installation:

6. Installation is the reverse of the removal procedure.
When attaching the wire cables make sure that they are connected correctly and in such a way that the regulating valves, the air flaps in the defroster nozzles and the fresh-air flap can be closed **completely.** (Check by operating the cables a number of times).

Job No.
83-2

Heating and Ventilation on Model 230 SL

A. Removal and Installation of Operating Assembly for Fresh-Air Flaps, Mixed-Air Flaps, Heat Exchanger, and Distribution Box

Removal:

1. Remove the glove compartment (see Job No. 68-1).

2. Remove the clock (see Job No. 54-12).

3. Take out the reading light (2) from the center padding (1) and disconnect the cable (Fig. 83-2/1).

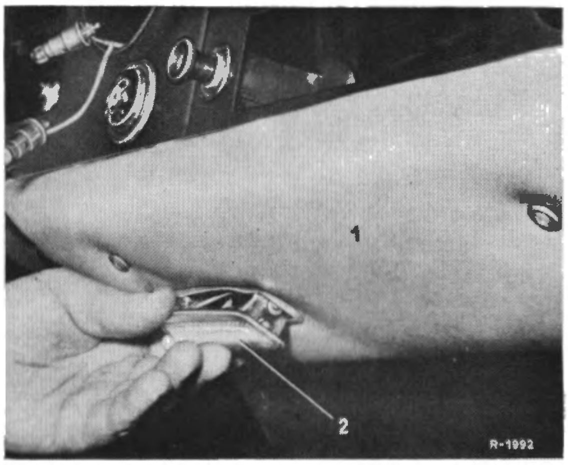


Fig. 83-2/1

1 Center padding
2 Reading light

4. Unscrew the center padding (1) and remove.

5. Slightly lift off the cover (1) with the model number at the upper edge by means of a flat wooden wedge (2), pushing it upward at the same time and remove (Fig. 83-2/2). Pull out the electric plug (4) from the cigar lighter (3) (Fig. 83-2/4).

6. Unscrew the center cover of the instrument panel and remove together with the ornamental molding (2) and the cigar lighter (3) (Figs. 83-2/3 and 4).

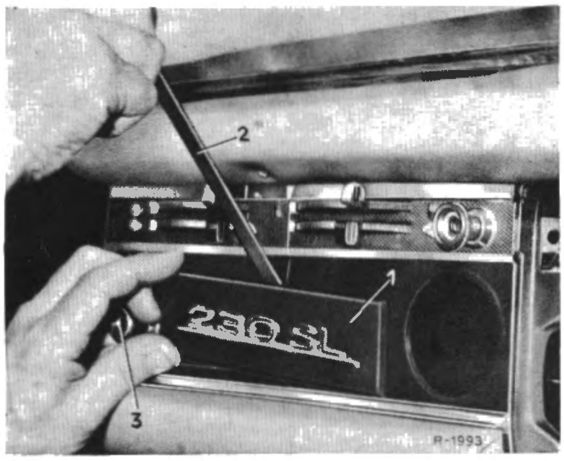


Fig. 83-2/2

1 Cover with model number
2 Flat wooden or plastic wedge
3 Cigar lighter

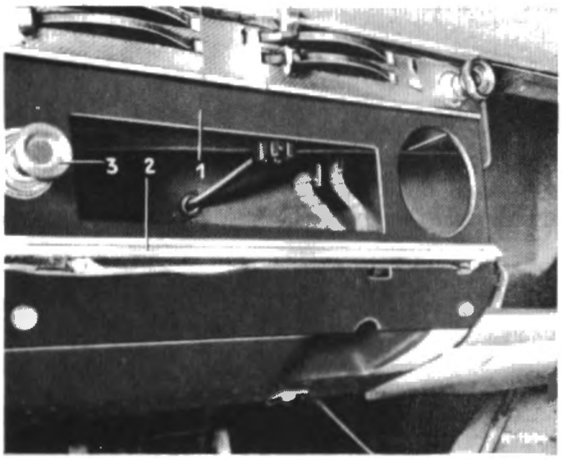


Fig. 83-2/3

1 Center cover instrument panel
2 Ornamental molding
3 Cigar lighter

7. Disconnect the control cable (1) for the right mixed-air flap from the operating disk (2). In the same way disconnect the control cable for the left mixed-air flap from the operating disk (3) (Fig. 83-2/5).

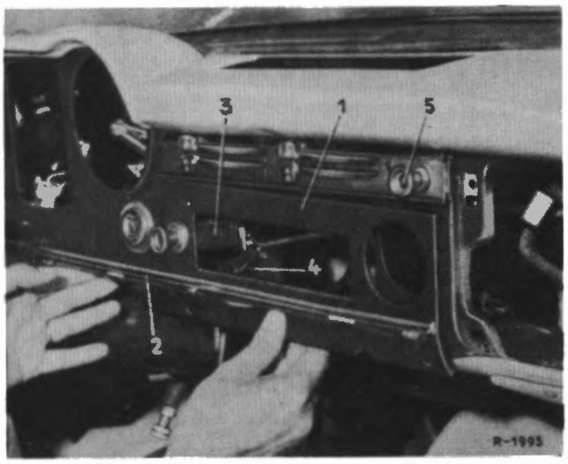


Fig. 83-2/4

1 Center cover instrument panel
2 Ornamental molding
3 Cigar lighter
4 Plug
5 Blower rotary switch

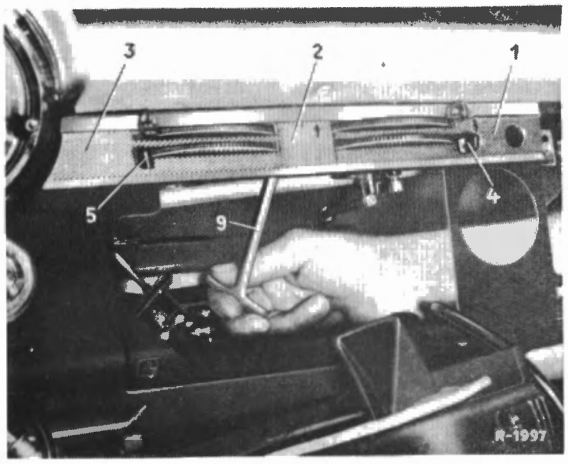


Fig. 83-2/6

1 Right escutcheon
2 Center escutcheon
3 Left escutcheon
4 Operating disk for the right mixed-air flap
5 Operating disk for the left mixed-air flap and heat exchanger
9 Articulated wrench

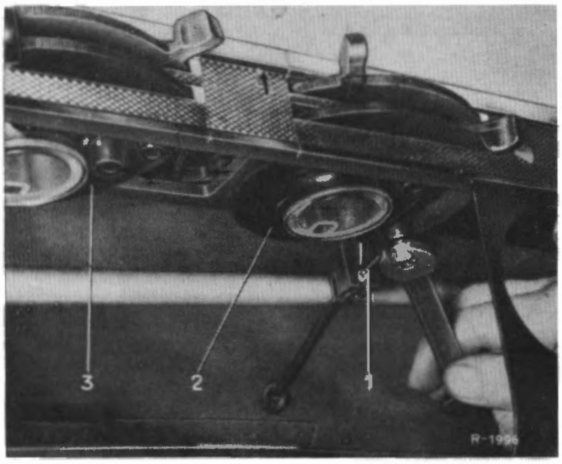


Fig. 83-2/5

1 Control cable for right mixed-air flap
2 Operating disk for right mixed-air flap
3 Operating disk for left mixed-air flap and heat exchanger

8. Remove the blower switch (5) (Fig. 83-2/4).

9. Unscrew the three-part escutcheon (1, 2 and 3) for the operating system.

Note: In order to unscrew the nuts with an articulated wrench (9) the red operating disks (4) and (5) for the mixed-air flaps are always moved into the opposite end position, i. e. to screw off the two outside nuts move the operating disks inward and to unscrew the center nuts move them outward (Fig. 83-2/6).

10. Remove the three-part escutcheon (1, 2 and 3) from the right toward the left in the sequence 1, 2, 3. The three parts of the escutcheon are locked by a tooth system (Figs. 83-2/7 and 8).

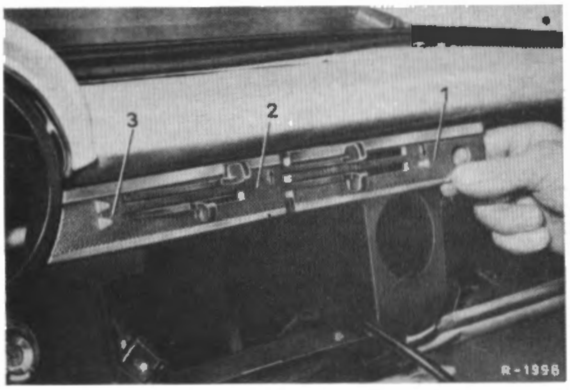


Fig. 83-2/7

1 Right escutcheon
2 Center escutcheon
3 Left escutcheon

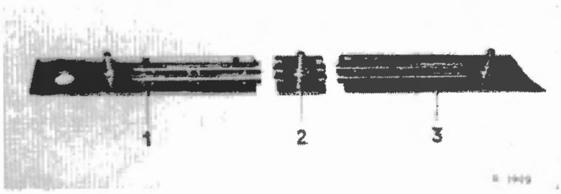


Fig. 83-2/8

1 Right escutcheon
2 Center escutcheon
3 Left escutcheon

11. Tilt the operating system (1) downward and disconnect the control cable (2) for the distribution box and the control cable (3) for the fresh-air flap from the operating disks (4) and (5) (Fig. 83-2/9).

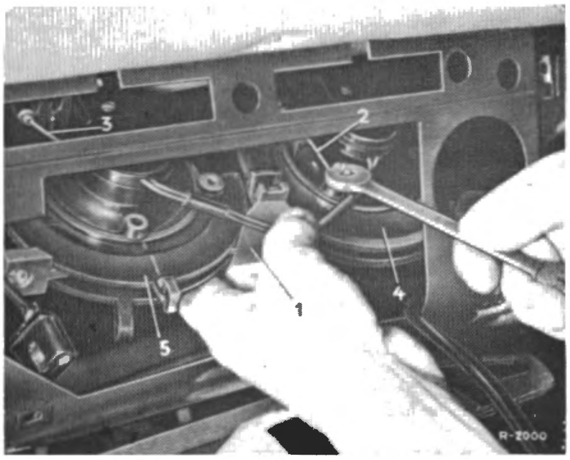


Fig. 83-2/9

1 Operating system
2 Control cable for distribution box
3 Control cable for fresh-air flap
4 Operating disk for distribution box
5 Operating disk for fresh-air flap

12. After disconnecting the cable remove the operating system from the instrument panel (Fig. 83-2/10).

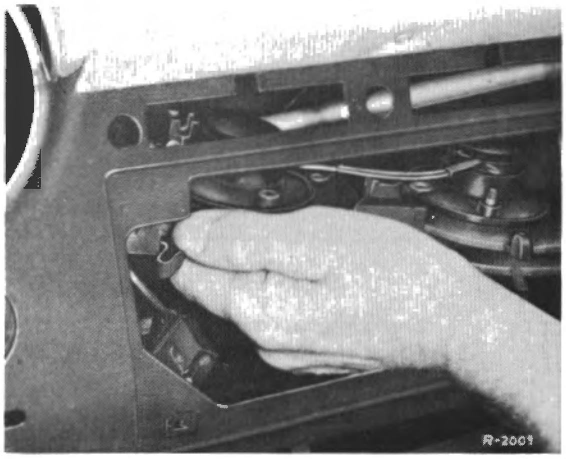


Fig. 83-2/10

Installation:

13. Installation is the reverse of the removal procedure.

B. Removal and Installation of the Distribution Box

Removal:

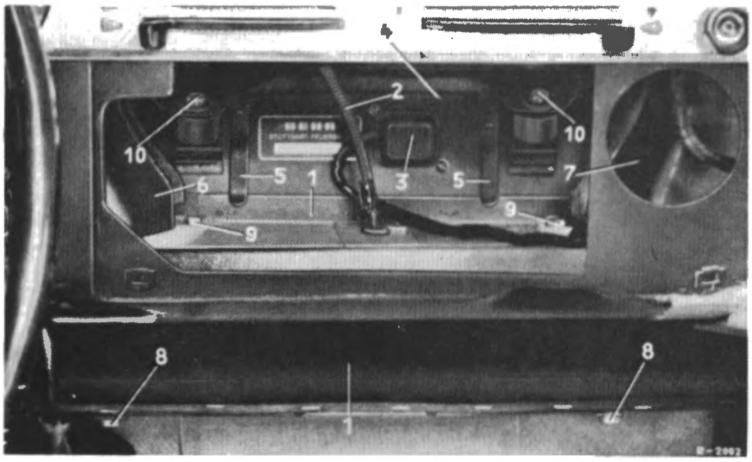


Fig. 83-2/11

1 Distribution box
2 Operating wire cable
3 Electric plug
4 Radial blower
5 Retaining spring
6 Left defroster nozzle
7 Right defroster nozzle
8 Fixing screw for distribution box
9 Fixing screw for defroster nozzle
10 Fixing screw for radial blower

1. Disconnect the control cable (2) for the distribution box from the operating disk (4) (Fig. 83-2/9). In order to do this carry out the operations described in Section A, paras 1 to 6 and 8 to 11.

2. Remove the cover (3) under the center of the instrument panel (see Fig. 68-1/1).

3. Unscrew the left (6) and the right (7) defroster nozzles from the distribution box (screws (9) shown in Fig. 83-2/11).

4. Unscrew the distribution box (1) from the radial blower (4) (screws (10) shown in Fig. 83-2/11).

5. Slide the distribution box (1) downward and out of the retaining springs (5) and remove together with the control cable (2) (Fig. 83-2/11).

Installation:

6. Installation is the reverse of the removal procedure.

C. Removal and Installation of Radial Blower

Removal:

1. Remove the distribution box (1) (see Section B, paras 1 to 5). Do not detach the control cable (2) but suspend the distribution box from the control cable and move it toward the left (Fig. 83-2/12).

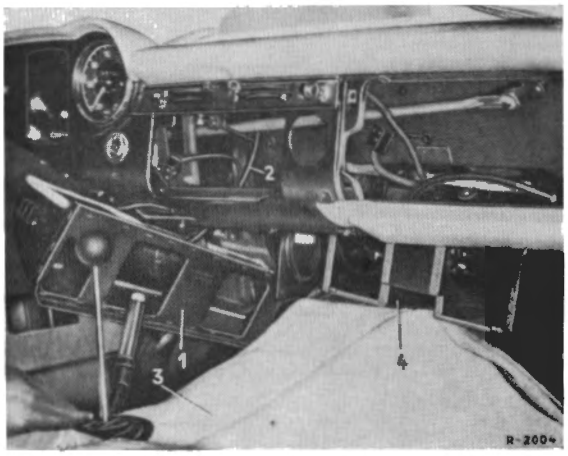


Fig. 83-2/12

1 Distribution box
2 Control cable
3 Carpet on transmission tunnel
4 Radial blower

2. Pull out the plug (3) from the blower (4) (Fig. 83-2/11).

3. Unscrew the left and right cap (2) from the radial blower (4) and remove (screws (1) shown in Fig. 83-2/13).

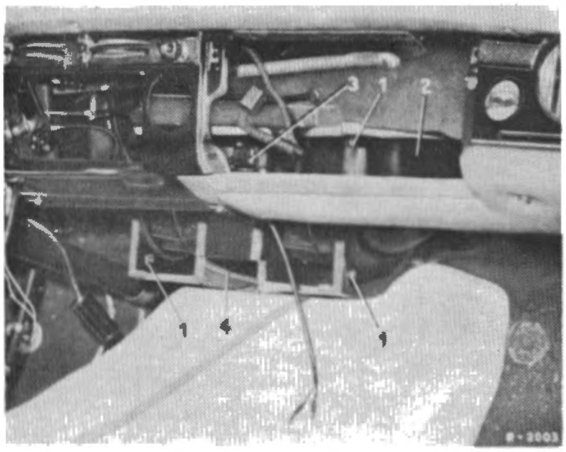


Fig. 83-2/13

1 Fixing screw for cap
2 Right cap
3 Electric plug
4 Radial blower

4. Remove connecting hose (15) for side window defrosting. Take out the right defroster nozzle (Fig. 83-2/20).

5. Remove the water drain hose from the right water tank (Fig. 83-2/14).

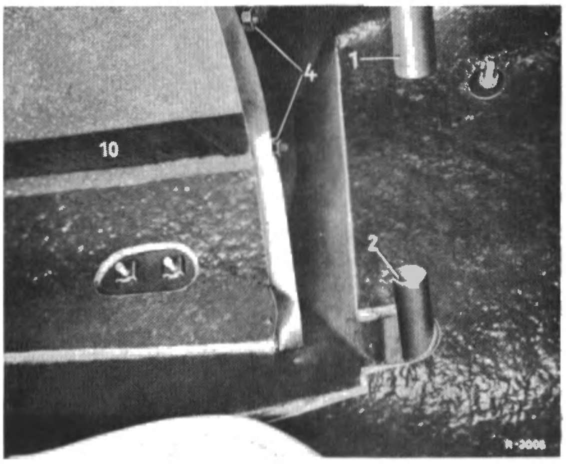


Fig. 83-2/14

1 Pipe union for water drain hose
2 Pipe union for water drain hose
4 Fixing screw for heat exchanger
10 Heat exchanger

6. Unscrew the fixing bracket (1) for the blower (4) from the transmission tunnel (Fig. 83-2/15).

Caution! The nut must be held steady from below. It is accessible as follows:
A helper stands to the left of the engine compartment and reaches down into the transmission tunnel with his left hand.
Be careful when the engine is hot!

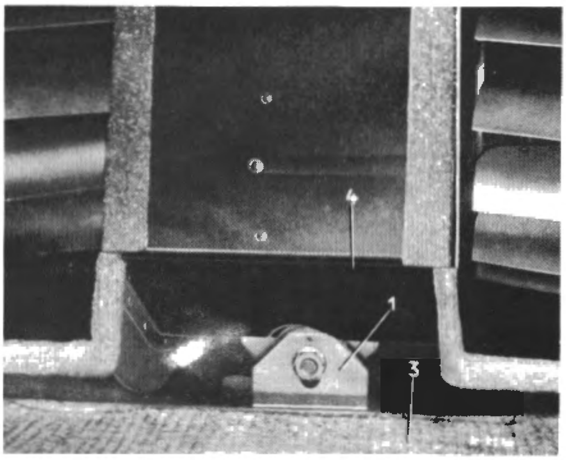


Fig. 83-2/15

1 Fixing bracket
3 Carpet on transmission tunnel
4 Radial blower

7. Unscrew the two top fixing screws (10) from the top of the radial blower left and right (Fig. 83-2/11).

8. Slightly loosen the carpet (3) on the center transmission tunnel on the right side and carefully take out the blower (4) toward the right (Fig. 83-2/12).

Installation:

9. Installation is the reverse of the removal procedure.

D. Removal and Installation of Heat Exchanger

Removal:

1. Drain the cooling water. Detach the feed and return hoses from the heat exchanger. Remove radial blower (see Section C).

2. Remove the ornamental grille of the scoop from the cowl.

3. Unscrew the scoop (1) left and right from the cowl. Then loosen the four center screws (2) and lift out the scoop upward (Fig. 83-2/16).

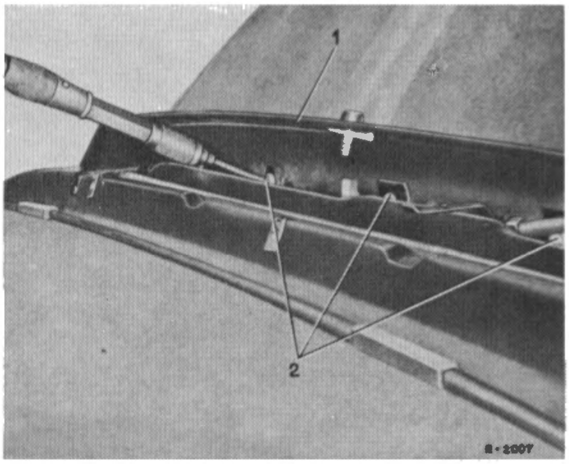


Fig. 83-2/16

1 Scoop
2 Fixing screw

4. Unscrew the right or left hinge (1) of the fresh-air flap (6). Lift the fresh-air flap (6) out of the opposite mounting (3) and detach the control cable (4) in the center (Fig. 83-2/17).

5. Remove the fresh-air cleaner (7) (Fig. 83-2/18).

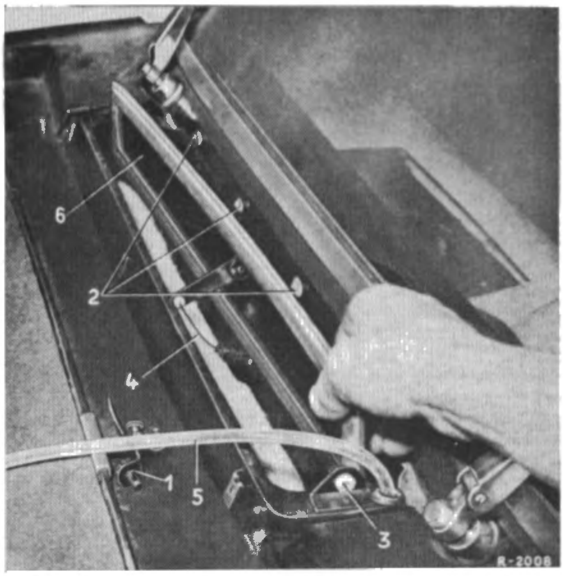


Fig. 83-2/17

1 Fresh-air flap hinge
2 Fixing screw for scoop
3 Bearing bushing for fresh-air flap
4 Control cable for fresh-air flap
5 Windshield washer hose
6 Fresh-air flap

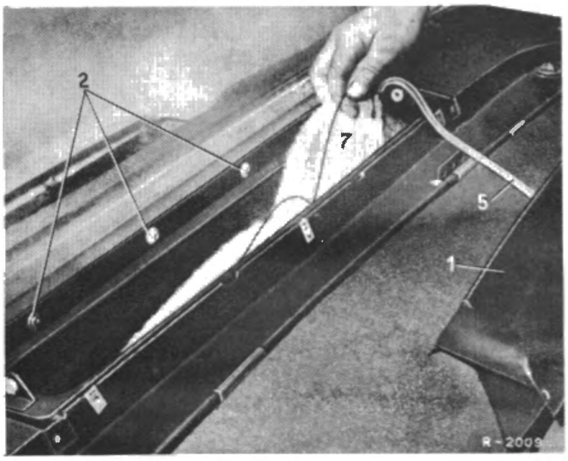


Fig. 83-2/18

1 Scoop
2 Fixing screws for scoop
5 Windshield washer hose
7 Air cleaner

6. Open the right mixed-air flap and detach the ball cup (9) of the operating linkage for the heat exchanger at the mixed-air flap (8) — not at the heat exchanger itself — and put it on top of the heat exchanger (Fig. 83-2/19).

7. Unscrew the heat exchanger (10) at the left and at the right and remove downward (Fig. 83-2/14).
Do not damage the hose unions!

Installation:

8. Installation is the reverse of the removal procedure.

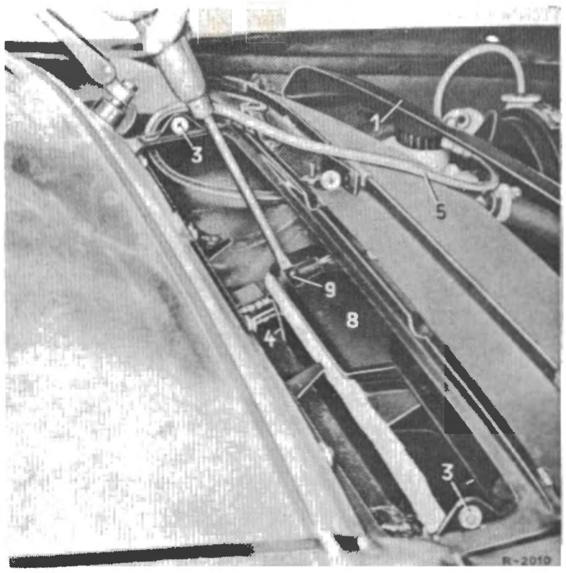


Fig. 83-2/19

1 Scoop
3 Bearing bushing for fresh-air flap
4 Control cable for fresh-air flap
5 Hose
8 Left mixed-air flap
9 Ball cup for operating heat exchanger

E. Removal and Installation of Right Defroster Nozzle

Removal:

1. Remove glove compartment (see Job No. 68-1).
2. Remove the distribution box (see Section B).
3. Remove the connecting hose (15) for side window defrosting (Fig. 83-2/20).
4. Detach the drive rod (16) from the drive crank of the wiper motor.

Caution: Do not change the drive rod adjustment!

5. Take out the right defroster nozzle (7).

Installation:

6. Installation is the reverse of the removal procedure. When installing the defroster nozzle pay attention to the rubber mounting in the instrument panel!

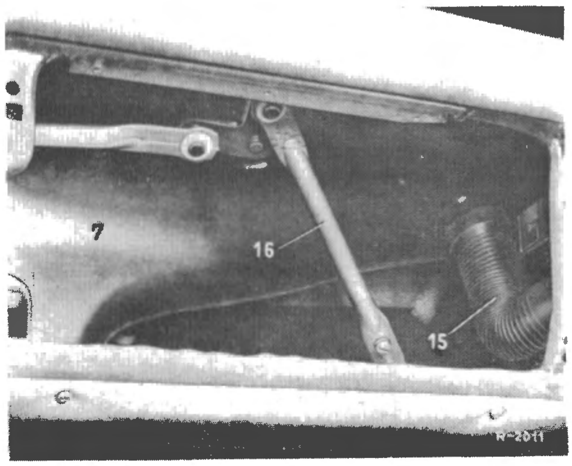


Fig. 83-2/20

7 Right defroster nozzle
15 Connecting hose for side window defrosting
16 Windshield wiper drive rod

F. Removal and Installation of Left Defroster Nozzle

Removal:

1. Remove the glove compartment (see Job No. 68-1).
2. Remove the distribution box (see Section B).
3. Remove support and pedals (see Job No. 29-1, Section B).
4. Remove the connecting hose for side window defrosting.
5. Take out the defroster nozzle downward.

Installation:

6. Installation is the reverse of the removal procedure.

Job No.
83-3

Heating and Ventilation

Models 250 S, 250 SE, 300 SEb, 300 SEL

A. Removal and Installation of Connecting Duct for Rear Compartment Heating

Removal:

1. Remove the mats from the front floor and the tunnel.

2. Remove the right cover panel below the instrument panel.

3. Detach the foam rubber from the heating ducts and turn out the screws (1) on the connecting duct (Fig. 83-3/1).

4. Pull the connecting duct (2) out of the guide on the heater box (3).

Installation:

5. Installation is the reverse of the removal procedure; make sure that the connecting duct engages properly in the guides on the heater box.

Note: The foam rubber on the connecting duct (2) must not be damaged and must be correctly positioned to provide proper sealing of the air duct.

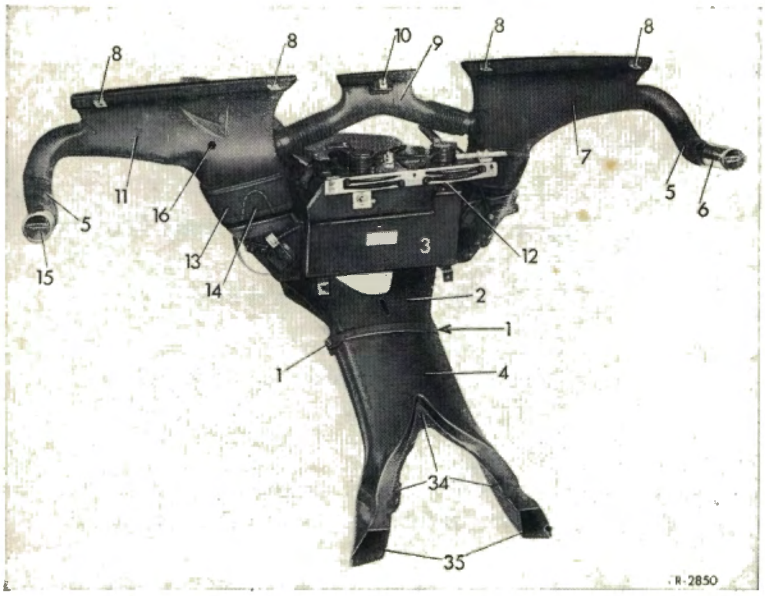


Fig. 83-3/1

1 Screw on connecting duct
2 Connecting duct
3 Heater box
4 Heating duct for rear compartment heating
5 Connecting hose
6 Right annular nozzle
7 Right defroster nozzle
8 Clips
9 Center defroster nozzle
10 Self-tapping screw
11 Left defroster nozzle
12 Cable plug
13 Rubber ring
14 Aperture
15 Left annular nozzle
16 Hole for speedometer cable
34 Oval head tapping screw
35 Seal

B. Removal and Installation of Heating Duct for Rear Compartment Heating

Removal:

1. Remove the connecting duct for the rear compartment heating (see Section A).

2. Unscrew the oval head tapping screws (34) from the heating duct (4) (Fig. 83-3/1).

3. Pull the heating duct together with the seals (35) out of the cross member and remove.

Installation:

4. Installation is the reverse of the removal procedure.

C. Removal and Installation of Right Defroster Nozzle

Removal:

1. Remove the right cover panel below the instrument panel.
2. Remove the glove compartment (see Job No. 68-2).
3. Remove the upper padding from the instrument panel (see Job No. 68-3).
4. Remove the clips (8) for the right defroster nozzle (7) (Fig. 83-3/1).
5. Pull off the connecting hose (5) for the right annular nozzle (6) from the defroster nozzle (7).
6. Lift the defroster nozzle, pull it out of the connection with the center defroster nozzle (9) and remove downward.

Installation:

7. Installation is the reverse of the removal procedure.

D. Removal and Installation of Center Defroster Nozzle

Removal:

1. Remove the right defroster nozzle (Section C).
2. Remove the loudspeaker cover.
3. Turn out the self-tapping screw (10) in the loudspeaker recess (Fig. 83-3/1).
4. Pull the defroster nozzle (9) out of the connection with the left defroster nozzle (11) and remove downward.

Installation:

5. Installation is the reverse of the removal procedure.

E. Removal and Installation of Heater Box with Heat Exchanger and Blower

Removal:

1. Drain the coolant.
2. Detach the ground cable from the battery.
3. Disconnect the feed and return pipes of the heat exchanger in the engine compartment at the cowl.
4. Take off the steering wheel.
5. Remove the connecting duct for the rear compartment heating (see Section A).
6. Remove the right defroster nozzle (see Section C).
7. Remove the center defroster nozzle (see Section D).
8. Remove the model designation panel from the instrument panel. If a radio is installed remove the set together with the loudspeaker.
9. Remove the ashtray and ashtray housing.
10. Pull out the cable plug (12) for the blower (Fig. 83-3/1).
11. Disconnect the operating cables for the heating (see Section G, Paras. 8 and 9).
12. Turn out the screws (17) and (18) for the attachment of the heater box (Fig. 83-3/2).
13. Remove the two screws of the clips (8) on the left defroster nozzle (Fig. 83-3/1).
14. Disconnect the speedometer cable from the transmission and the instrument cluster (see Job No. 54-11 a) and pull it out of the left defroster nozzle upward.

Note: The speedometer cable runs through the hole (16) in the left defroster nozzle.

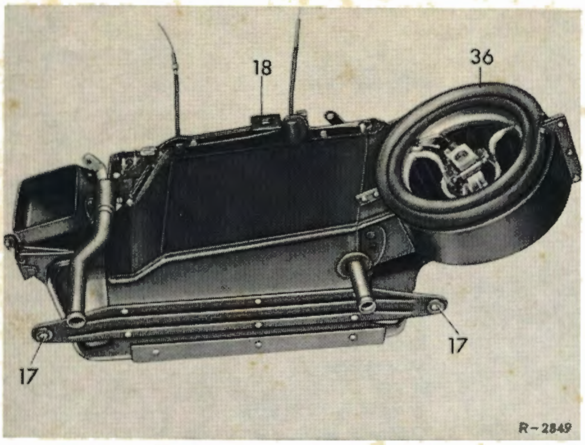


Fig. 83-3/2

17 Screws for attaching the heater box to the cowl
18 Screws for attaching the heater box to the instrument panel
36 Rubber seal

15. Lift the left defroster nozzle, fold up the rubber ring (13) at the front and slide the defroster nozzle with the aperture (14) over the steering lock (Fig. 83-3/1).

16. Take out the heater box toward the lower right, paying attention to the feed and return pipes of the heat exchanger.

Note: To prevent possible injuries put rubber caps on the wire cable ends after having removed the heater box.

Installation:

17. Installation is the reverse of the removal procedure; lightly grease the rubber grommets in the cowl before starting installation procedures. Lightly grease the rubber seal (36) before installation (Fig. 83-3/2). Make sure that the rubber seal fits properly to the blower connection. When fitting the screws (17 and 18) begin with the left screw because access is difficult.

For connection and adjustment of the wire cables for the operating assembly see Section G.

F. Removal and Installation of Left Defroster Nozzle

Removal:

With heater box removed

Remove the clip (8) from the left defroster nozzle and pull the nozzle out downward to the right, paying attention to the connecting hose (5) (Fig. 83-3/1).

With heater box installed

1. Remove the pedal system (Job No. 29) and the holder for the sleeve union on the left lower side of the instrument panel.

2. Remove the upper padding from the instrument panel (see Job No. 68-3, Section A).

3. Disconnect the speedometer cable at the transmission and at the instrument cluster (see Job No. 54-11 a) and pull it out upward from the left defroster nozzle.

Note: The speedometer runs through the hole (16) in the left defroster nozzle (Fig. 83-3/1).

4. Remove the clips (8) and the connecting hose (5) of the left defroster nozzle and pull out the nozzle downward to the left (Fig. 83-3/1).

Installation:

5. Installation is the reverse of the removal procedure.

G. Removal and Installation of Operating Assembly for Heating and Ventilation

Removal:

1. Remove the right panel below the instrument panel.

2. Remove the loudspeaker cover.

3. Remove the model designation panel from the instrument panel. If a radio is installed remove the radio together with the loudspeaker.

4. Remove the ashtray together with its housing.

5. Pull off the handles (20) (Fig. 83-3/3).

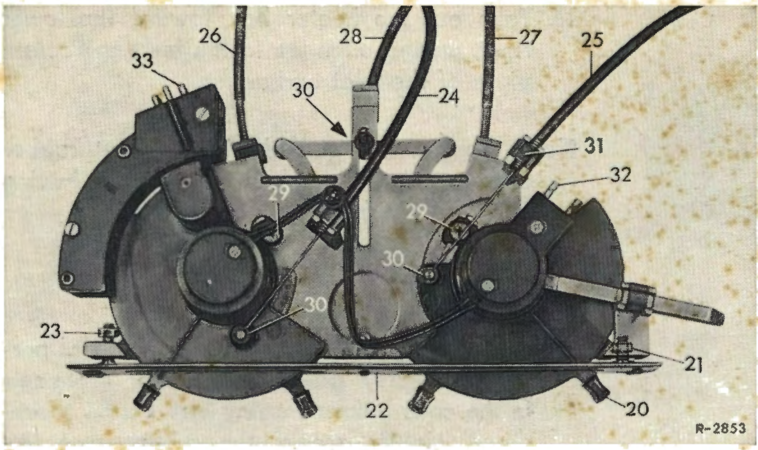


Fig. 83-3/3

20 Handle
21 Right nut
22 Escutcheon
23 Left nut
24 Operating cable for fresh-air flaps
25 Operating cable for air distribution flaps
26 Operating cable for left heater flap
27 Operating cable for right heater flap
28 Operating cable for faucet
29 Clamping screw for heater flap cables
30 Snap ring
31 Clip
32 Lighting cable plug
33 Blower cable plug

6. Reach through the opening for the ashtray in the instrument panel and remove the right nut (21) of the escutcheon (22).

7. Move the left operating disk for the heating and the operating disk for the fresh-air flap as far as the right stop.

8. Reach through the opening for the radio in the instrument panel, remove the left nut (23) of the escutcheon and remove the escutcheon.

9. Adjust the operating disks to the position shown in Fig. 83-3/3.

10. Unscrew the screws (29) of the operating cables (26 and 27) for the heater flaps, holding them steady from below with a screwdriver. Remove the snap rings (30) from the other operating cables (24, 25, and 28) and detach all clips (31). Then pull out the operating cables.

11. Remove the operating assembly downward between the instrument panel and the heater box.

Fig. 83-3/4

19 Heater flap

Installation:

12. Installation is the reverse of the removal procedure.

Note: Adjust the wire cables (26 and 27) (Fig. 83-3/3) in such a way that the heater flaps (19) are **fully closed** (Fig. 83-3/4) while the operating levers are still approx. 10 mm away from the stop. With this adjustment the heater flaps will close the fresh-air duct with a certain initial tension.
The clips (35) can be fixed with Pliers (38) 108 589 01 37 00 (Fig. 83-3/5).

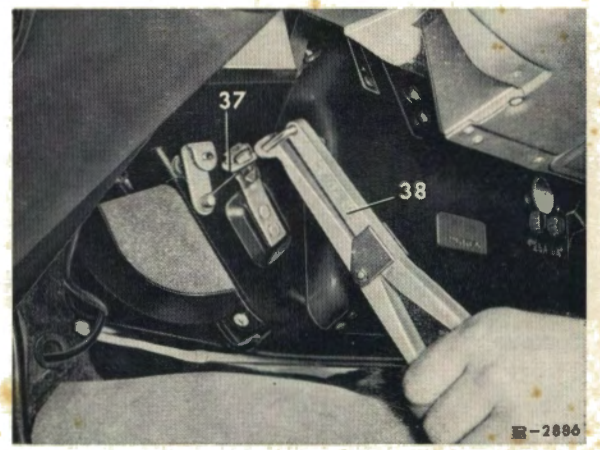


Fig. 83-3/5

37 Clip
38 Pliers 108 589 01 37 00